DOCUMENT RESUME

ED 259 042 UD 024 301

AUTHOR Landis, Raymond B., Ed.
TITLE Improving the Retention and Graduation of Minorities in Engineering. Handbook.
INSTITUTION National Association of Minority Engineering Program Administrators.
SPONS AGENCY National Action Council for Minorities in Engineering, Inc., New York, NY.
PUB DATE 85
NOTE 147p.
PUB TYPE Guides - Non-Classroom Use (055) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS American Indians; Black Students; *College Programs; *Dropout Prevention; *Engineering Education; Higher Education; Hispanic Americans; *Minority Groups; *Program Development; *Program Implementation; School Holding Power

ABSTRACT

Procedures for operating undergraduate minority engineering programs (MEPs) are provided in this handbook. The findings and suggestions presented are based on the experiences of MEP directors who have managed support programs, which focus on improving the retention of minority students within engineering. The titles and authors of the handbook's 16 chapters are as follows: (1) "The Case for Retention Programs" (Deborah Minor); (2) "A Model Retention Program" (Raymond B. Landis); (3) "Recruiting and Admissions" (Margaret E. Boulding); (4) "Matriculation and Summer Bridge Programs" (Ronald L. Glenn and Raymond B. Landis); (5) " A Model Orientation Program" (Raymond B. Landis and Kathy Hada); (6) "Strategies for Monitoring Student Progress and Maintaining Retention Data" (Benson E. Penick); (7) "Minority Engineering Student Organizations" (Joel Nossof); (8) "A Model Academic Support System" (Uri Treisman); (9) "Tutoring and Student Study Centers" (Richard Ortega and Christine Reyes); (10) "Academic Advising" (G.F. Paskusz); (11) "Personal and Career Counseling" (Ron Simmons and Cassandra Maxwell-Simmons); (12) "Financial Aid" (Esteban Soriano); (13) "Pre-Professional Employment" (Chenits Pettigrew and Kathryne J. Kelsick); (14) "Developing Faculty Involvement" (Enrique Ainsworth); (15) "Developing Institutional Support" (Nathaniel Thomas and William E. Hogan II); and (16) "Developing External Support" (David Blackman). Two appendices include an MEP Evaluation Form and a list of authors and their affiliations. (KH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

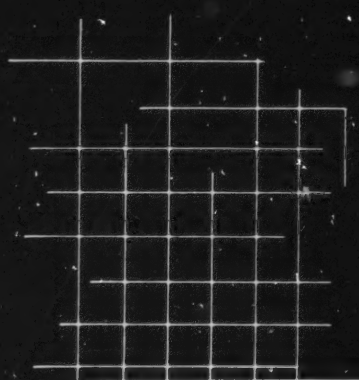
ED259042

BEST COPY AVAILABLE

HANDBOOK

Improving the Retention and Graduation of Minorities in Engineering

Edited by Raymond B. Landis



U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Ronni Denes
Nat'l. Action Cncl for Minorities in Engineering
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

UD 024301

The National Action Council for Minorities in Engineering

The National Association of Minority Engineering Program Administrators

2

HANDBOOK
ON
IMPROVING THE RETENTION AND GRADUATION OF MINORITIES IN ENGINEERING

Edited by
Raymond B. Landis

A Project of

The National Association of Minority
Engineering Program Administrators

Funded by

The National Action Council for Minorities in Engineering, Inc.
3 West 35th Street, New York, NY 10001

DEDICATION

This Handbook is dedicated to a champion of minority engineering programs Al Richardson (1927-1985). His advocacy, contact with students and faculty, and role in key activities over the past decade inspired many to take on the minority engineering challenge.

Copyright © 1985 by NACME, Inc.

All rights reserved. No part of this publication may be reproduced, except for the inclusion of brief quotations in a review, without the prior written permission of the publisher.

FOREWORD

by Robert Finnell
President, NACME, Inc.

Blacks, Hispanics, and American Indians earning baccalaureate degrees in engineering have tripled in number since the early 1970s. The increase follows a major initiative by industry, universities, foundations, professional societies, and minority organizations to prepare underrepresented minorities for an active role in America's technologically oriented economy.

Crucial to the task of making minority engineers a visible part of the profession has been the work carried on continuously by administrators of undergraduate minority engineering programs (MEPs). Their efforts are described in this Handbook, *Improving the Retention and Graduation of Minorities in Engineering*. The National Action Council for Minorities in Engineering (NACME) is pleased to have funded and published this Handbook as a project of the National Association of Minority Engineering Program Administrators (NAMEPA).

Dedicated and energetic MEP directors have correctly focused the Handbook on the specific tasks that produce graduates. Through conscious planning, through interaction with each other, and through trial and error, the MEP directors have developed a well-designed approach to improving retention and, subsequently, graduation rates. Although occasional papers or workshops have covered elements of MEP programs, their approaches have not been documented in detail.

In remedying that deficiency, the authors of this Handbook have written the most complete publication to date on the tasks carried out by MEP directors and their associates.

PREVIOUS RETENTION STUDIES AND REPORTS

The minority engineering programs described in *Improving the Retention and Graduation of Minorities in Engineering* represent a major step forward when viewed within the context of previous publications.

The seminal 1974 report, *Minorities in Engineering: A Blueprint for Action*, made numerous recommendations to improve graduation rates, including suggestions that schools of engineering provide tutorial programs, improved orientation and counseling, flexible curricula, and other services. The Alfred P. Sloan Foundation's support of this study and many subsequently funded minority engineering activities produced a variety of responses to the report's recommendations.

In September, 1975 the Committee on Minorities in Engineering (CME) at the National Research Council published *Building Effective Minority Programs in Engineering Education*. It reported on the early progress in implementing MEPs, briefly discussed elements of effective programs, and then described individual programs at a number of engineering schools.

Proceedings of a Workshop for Program Directors in Engineering Education of Minorities, published by the CME in 1976, was the report on the ideas and experiences of professionals and volunteers that were exchanged at a June 12-14, 1975 workshop. The workshop was organized around four themes: (1) administrative skills and resources for MEP directors, (2) increasing the pool of minority students, (3) the development of minority engineering students, and, (4) retention.

The refinement of retention approaches was also documented by the CME in late 1977 with the publication of *Retention of Minority Students in Engineering*. The study dealt with the high attrition rate among minorities at engineering colleges and recommended actions to correct the disparity between enrollment and graduation rates. It identified program characteristics and institutional variables that affected retention and suggested future studies that would analyze both students and programs.

Finally, NACME's *The Retention of Minority Engineering Students*, part of the 1981-82 Retention Research Program, presented findings based on 11 funded projects and 51 proposals. The study identified support mechanisms that were significantly related to retention success.

In summary, previous studies documented the high attrition rate of minority students in engineering, identified causes of attrition, recommended strategies to improve retention rates, and identified specific support mechanisms that improved student academic performance.

This Handbook, *Improving the Retention and Graduation of Minorities in Engineering*, contrasts with previous reports and represents a maturing of the minority engineering effort because it provides detailed operating procedures developed by MEP directors who have managed undergraduate support programs for from 5 to 12 years.

USES OF THIS REPORT

NACME supported NAMEPA's project to increase productivity and stimulate constructive investments in the minority engineering effort. First, the Handbook provides a guide to those desiring to initiate MEPs or improve existing programs. Second, investors will have a clear guide for evaluating programs aimed at graduating more minority engineers.

We also anticipate that this Handbook will provide details about a model that has applicability for disciplines and professions other than engineering; it can also assist those assessing the approaches to providing cost-effective support services to undergraduates. Programs aimed at increasing minority graduates in business, pre-medical programs, the sciences, the social sciences, and related fields should find in the Handbook an approach that merits attention.

It can also be used by local, state, or federal agencies and offices charged with policy or budgetary responsibilities for education.

Because of decreased levels of support for education and the increasing percentage of minorities in large states and metropolitan areas, the education of minorities will continue to be a major financial issue for secondary schools and universities. By writing about the refinement of MEPs in the climate of the past ten years, the authors have demonstrated how to allocate scarce funds to achieve desirable educational results. The message of this Handbook communicates a different set of priorities than those currently used to distribute educational funds. It is a message that should be heard by those desiring to strengthen America by developing the potential of Black, Mexican American, Puerto Rican, and American Indian students.

WHY THE MEP TECHNOLOGY WORKS

The MEP technology in this Handbook describes solutions to specific opportunities encountered by MEP directors. Why did the MEP technology work when others failed? Seven aspects of the technology account for its success.

1. MEPs used a comprehensive approach to working with students. Directors addressed academic, nonacademic, peer, institutional, and other influences on the student.

2. MEPs were based in an academic unit of the university. Directors were responsible and reported to the dean or a faculty member. Contacts with other faculty were direct rather than through a bureaucracy external to the academic unit.

3. MEP directors operating the program were professionally oriented. They were not on faculty tenure tracks nor were they on corporate or government payrolls, loaned to run an MEP on a part-time basis. Their career future was linked to the success of the program. Thus, it was in their interest to refine program approaches and components, share their findings, and develop common evaluation mechanisms.

4. Time on task was spent, not on abstract discussion, but on practical program problem-solving and improvement of practices. The question underlying the many topics in this Handbook is "What do I do to increase minority graduation rates in engineering?" When an approach worked, the MEP directors used it; when it didn't, they discarded it.

5. Results-oriented measures were used in MEP programs. Freshman recruitment, persistence rates, and graduation lists informed faculty, students, industry, and others of the outcome of their investments.

6. Professionals and volunteers from companies, professional societies, government agencies, minority organizations, and other groups assisted the professional staff. Their diverse backgrounds and institutional base (apart from the university) insured that the hard questions would be asked: Who graduated? Who is persisting, and why?

7. Finally, the MEP technology evolved because of the quality of

the engineering faculty and administrators associated with MEPs. These "volunteers" often came from the most prestigious engineering schools and were leaders in their disciplines. Often, they moved on to occupy key positions in engineering, education, professional societies, and industry.

CONCLUSION

Improving the Retention and Graduation of Minorities in Engineering is a major contribution to achieving one of America's oldest dreams: developing opportunity for all its citizens. It describes how MEP technology enables minority students to achieve higher success rates in engineering — one of the key disciplines for attaining economic and decision-making influence in America. The ability of the MEP directors to produce more engineering graduates, increase retention rates, and communicate how they achieved their success justifies the decision investors made to risk financial and human resources in a venture to alter the historical pattern of underrepresentation of minorities in engineering. If this Handbook's recommendations are heeded by educators and others, it will create the opportunity for further successes in the minority engineering effort.

ACKNOWLEDGMENTS

The purpose of this Handbook is to document much of what has been learned over the past ten to twelve years across the nation by those working to build support programs for underrepresented minority students within our colleges and schools of engineering. The quality of this publication can be attributed not only to the authors of each chapter, who in spite of their extremely demanding jobs put forth a tremendous effort, but also to a number of other individuals and organizations whose contributions deserve to be acknowledged.

The Handbook was a project of the National Association of Minority Engineering Program Administrators (NAMEPA) with funds provided by the National Action Council for Minorities in Engineering, Inc. (NACME). Much credit is due to Dr. Lloyd Cooke, President Emeritus of NACME, who enthusiastically supported the project from its conception and made the funding possible. Many thanks also to current NACME President Robert Finnell for providing additional funds and NACME staff to upgrade the quality of the reproduction process to that which you see.

NAMEPA members and officers contributed to the project in many ways. Minnie McGee, NAMEPA President during most of the period of the project, provided a great deal of encouragement and helped with the development of a smooth approval process. NAMEPA Treasurer Betsy Yost handled the disbursement of the funds and was a real pleasure to work with. Jerry Paskusz, Jim Newton, Anthony Cabreros, Ron Glenn, and Winona Shilling comprised the committee which reviewed and approved each chapter on behalf of NAMEPA. Thanks also to those NAMEPA members listed on a following page who reviewed early drafts of each chapter and provided invaluable input.

The quality of writing can be attributed to an excellent group of writers/editors: Leah Freiwald, Kathy Hada, Gene Ulansky, Anna Larsen, and John Crow. Particularly noteworthy are the major contributions made by Leah Freiwald to Chapters 8, 15, and 16 and those of Kathy Hada to Chapters 5 and 11.

Many thanks to the Mathematics, Engineering, Science Achievement (MESA) program at the Lawrence Hall of Science at UC Berkeley where I was working during the 1983/84 academic year. Dr. Esteban Soriano, Executive Director of MESA, was particularly supportive and viewed the Handbook as an essential document for the fifteen California minority engineering programs (MEPs) funded by MESA. Thanks also to Vivian Arenas-Vellanoweth, who typed most of the Handbook on the MESA wordprocessor, for her excellent work, and to Wendy Gledhill who did some of the final typing at CSU Northridge.

I would also like to acknowledge a small number of the many people who supported my work in minority education over the years. Credit for guiding and inspiring me particularly in the early years goes to Al Richardson, Rodrigo Garcia, Lee Browne, Wallace Russell, Uri Treisman, and Bob Finnell. CSU Northridge engineering deans Charles Sanders and Alfonso Ratcliffe deserve much credit for providing a climate in which the CSU Northridge MEP program could develop and prosper. Thanks to Rick Ainsworth with whom I have worked closely almost from the beginning for his major contributions to the development and implementation of MEP and to others who worked with me at CSU Northridge: Mike Macias, Chenits Pettigrew, Barbara Caretto, Richard Ortega, Rochelle Brandon, and many others. I would be remiss if I did not acknowledge the many wonderful students who allowed me to become part of their educational experience and showed me that things don't have to be the way they are.

More recently, I have been immensely rewarded by the opportunity to oversee the implementation of model MEP programs in fourteen other California engineering schools. Through the dedication and commitment of the directors of those programs, we have shown that model MEP programs can work effectively under a wide variety of institutional differences and situations.

It is my hope that the Handbook will provide a technical basis which will encourage the initiation of new programs and stimulate the improvement of existing programs. With this as a base of knowledge to build on, I hope that we will continue to learn how to create a positive situation for ethnic students within our schools of engineering.

Raymond B. Landis
Northridge, California
January, 1985

REVIEWERS

The following individuals contributed to the Handbook by reviewing one or more of the initial chapter drafts:

Enrique Ainsworth
Manuel Aroz
Mel Bell
David Blackman
Margaret Boulding
Frances May Brooks
Tom Cummings
Cecil Curtwright
Jane Elliot
Kay Hudspeth
Sam Jackson
Carl Johnson
Irma Lozano
Roscoe McNealy
Anne Monterio
Carole Morning
Joel Nossoff
Richard Ortega
Paul Parker
Benson Penick
Chenits Pettigrew
Gwen Redding
Ron Simmons
Nate Thomas
David Weinstein
Reynolds Winslow
Betsy Yost

HANDBOOK COMMITTEE

The following individuals comprised the NAMEPA Handbook Committee. They each reviewed four of the initial chapter drafts and reviewed and approved the final version of each chapter on behalf of NAMEPA:

Anthony Cabreros
Ronald Glenn
James Newton
G. F. Paskusz
Winona Shilling

TABLE OF CONTENTS

	FOREWORD Robert Finnell	iii
	ACKNOWLEDGMENTS Raymond B. Landis	vii
Chapter 1.	THE CASE FOR RETENTION PROGRAMS Deborah Minor	1
Chapter 2.	A MODEL RETENTION PROGRAM Raymond B. Landis	7
Chapter 3.	RECRUITING AND ADMISSIONS Margaret E. Boulding	13
Chapter 4.	MATRICULATION AND SUMMER BRIDGE PROGRAMS Ronald L. Glenn and Raymond B. Landis	19
Chapter 5.	A MODEL ORIENTATION PROGRAM Raymond B. Landis and Kathy Hade	27
Chapter 6.	STRATEGIES FOR MONITORING STUDENT PROGRESS AND MAINTAINING RETENTION DATA Benson E. Penick	35
Chapter 7.	MINORITY ENGINEERING STUDENT ORGANIZATIONS Joel Nossoff	47
Chapter 8.	A MODEL ACADEMIC SUPPORT SYSTEM Uri Treisman	55
Chapter 9.	TUTORING AND STUDENT STUDY CENTERS Richard Ortega and Christine Reyes	67
Chapter 10.	ACADEMIC ADVISING G.F. Paskusz	73
Chapter 11.	PERSONAL AND CAREER COUNSELING Ron Simmons and Cassandra Maxwell-Simmons	87
Chapter 12.	FINANCIAL AID by Esteban Soriano	93
Chapter 13.	PRE-PROFESSIONAL EMPLOYMENT Chenits Pettigrew and Kathryne J. Kelsick	99
Chapter 14.	DEVELOPING FACULTY INVOLVEMENT Enrique Ainsworth	105
Chapter 15.	DEVELOPING INSTITUTIONAL SUPPORT Nathaniel Thomas and William E. Hogan II	113
Chapter 16.	DEVELOPING EXTERNAL SUPPORT David Blackman	117
Appendix A	MEP EVALUATION FORM	121
Appendix B	LIST OF AUTHORS	139

CHAPTER 1

The Case for Retention Programs

by Deborah Minor

Chicago Area Pre-College Engineering Program

INTRODUCTION

The readers of this Handbook will include those who are presently involved in aggressive retention efforts; those who have a lukewarm commitment to the cause; and, maybe, even those who seeing no need for retention programs at all, will, out of curiosity, give the handbook a cursory look. In any event, the authors of the text are firm believers in retention programs. From first-hand experience, they know that retention programs can make and have made a difference in the minority engineering effort.

A Historical Perspective

The case for retention programs cannot be clearly stated without providing a historical perspective on the minority engineering effort. We are becoming more and more accustomed to seeing Black, Puerto Rican, Mexican American, and American Indian engineers and scientists, but this is a fairly recent occurrence. We are all aware of the events that took place in the late sixties and early seventies, which literally forced the notion of equal opportunity upon American society. This social upheaval resulted in tremendous gains, socially and economically, for these ethnic groups. Progress, however, seemed to be elusive when it came to opportunities in specific career fields, most notably in engineering.

The Alfred P. Sloan Foundation commissioned a study of the issue and in 1974 published a report entitled "Minorities in Engineering: A Blueprint for Action." As a result, the National Academy of Engineering (NAE) agreed to serve as the focal organization in developing a national effort to increase the participation of historically underrepresented minorities in the field of engineering.

The National Academy of Engineering was the natural choice for this leadership role, since it had convened a major symposium in May 1973 where over 300 engineers, educators, and corporate leaders met and pledged to work to achieve proportional representation of minorities in the engineering profession. Specifically, the goal was to bring about a tenfold increase in minority engineering graduates within a decade.

To meet this goal, the NAE established the Committee on Minorities in Engineering. Its mission was to promote the development of activities on the national, regional, and local levels through studies, meetings, and the dissemination of information. The Committee's work was funded by approximately thirty major corporations which formed the National Advisory Council on Minorities in Engineering (NACME).

Also in the early seventies, the Engineer's Council for Professional Development (ECPD), the agency responsible for accrediting engineering schools, established the Minority Engineering Education Effort (ME^3). The primary focus of ME^3 was identification and motivation of minority high school students. ECPD also established the Minority Introduction to Engineering (MITE) program which conducted motivational summer programs for minority students between their junior and senior years in high school.

Lack of financial resources for minority students was always considered a barrier to increasing minority participation in engineering; thus, the formation of the National Fund for Minority Engineering Students. Organized in 1975, the Fund, as its title implies, provided scholarship support to minority engineering students.

Another contributor to the minority engineering effort is the National Coordinating Center for Curriculum Development, located at the State University of New York at Stony Brook. Established in 1976, the Center received a major grant from the Sloan Foundation for the purpose of developing curriculum materials to improve the problem-solving skills and math and science preparation of minority high school and junior high school students. This material is used by many of the regional pre-college programs throughout the nation.

In order to increase the enrollment and retention of minority engineering students at the graduate level, the National Consortium for Graduate Degrees for Minorities in Engineering (commonly called GEM) was established. Based at Notre Dame, the GEM program matches graduate educational institutions with corporations and government laboratories to provide combined educational and work experiences for talented minority engineering graduates.

By the late seventies, the minority engineering effort was well underway. The next significant change

occurred when ME³, the Committee on Minorities in Engineering, and the Fund were consolidated into one entity, the National Action Council for Minorities in Engineering (NACME, Inc.). This organization, based in New York City, supplanted the old NACME and assumed the roles of the pre-existing organizations. The new NACME has become a major force in the effort.

Most recently local and regional program directors on both the pre-college and university level decided to organize. As a result, there is now the National Association of Pre-College Directors (NAPD) and the National Association of Minority Engineering Program Administrators (NAMEPA). These "grass-roots" organizations work to improve the effectiveness of their members by conducting conferences, disseminating information, coordinating with other organizations involved in the effort, and pursuing numerous other activities.

RETENTION BARRIERS

Definite barriers exist that prevent minority students from successfully completing degree programs in engineering. A report of the Retention Task Force of the Committee on Minorities in Engineering entitled "Retention of Minority Students in Engineering,"[1] has clearly outlined some of the barriers that minority engineering students commonly face. The following causes of high attrition were noted:

- Insufficient preparation in mathematics and the physical sciences
- Inadequate motivation toward engineering as a career choice
- Lack of adequate financial resources
- Absence of self-confidence
- Personal and/or family problems of minority students
- Excessive expenditures of time for social and nonacademic student activities

Institutional factors that create barriers and fuel attrition add to the student-related factors noted above. Minority students attending predominantly white institutions are to a great extent ethnically isolated in their academic environment, and it is taken for granted that they will readily adjust. The majority groups of students as well as the faculty and the administration are not called upon to alter their attitudes or the institutional environment. The minority student is under great pressure to adjust or else.

Although adjustment to college life, socially and academically, is not an easy task for any student, institutional factors such as elitist attitudes, poor teaching, a general insensitivity to students, and lack of adequate student support programs make adjustment particularly difficult for minority students. When part of the freshman orientation session at a university includes telling students to look to their left and to their right, after which they are assured that one of the three (and at some places two!) will not make it to graduation, it is no wonder that entering minority students feel unwanted and unsupported by the institution.

With the increase in engineering enrollment overall, engineering schools face many serious problems which compound the situation. Inadequate resources, lack of space, and high student/faculty ratios further erode the environment that minority students encounter.

The Retention Task Force, referenced earlier, surveyed engineering schools to determine the key factors that effect the retention of minority engineering students. Based on the responses, primarily from MEP directors, the following factors, in rank-order of importance, were identified:

- Motivation toward engineering
- Math preparation prior to matriculation
- Academic performance
- Availability of adequate financial resources/aid
- Self-confidence of students to do the work
- Availability and quality of counseling
- Availability and quality of tutoring
- Personal/family problems
- Admissions criteria
- Existence of minority student organizations
- Rigidity/flexibility of curriculum
- Faculty attitude toward minority students
- Availability of summer/permanent jobs in engineering
- Social/economic background of students
- Attitude of minority students toward majority faculty/students
- Existence of minority faculty members
- Change in career goals
- School setting (rural vs. urban)
- Attitude of majority students toward minority students

Alexander Astin[2] surveyed 41,000 undergraduates at 358 two-year and four-year colleges and universities to determine why students drop out. Astin stated that "by far the greatest predictive factor in retention is the student's past academic record and academic ability. Next in importance are the student's degree plans at the time of college entrance, religious background and preference, followed by concern about college finances, study habits, and educational attainment of parents."

Minority students are particularly vulnerable to dropping out because of poor academic preparation. The development of effective pre-college programs that provide academic enrichment, especially in mathematics and science, have proved crucial in the retention of minority engineering students. These programs were needed to mitigate the effects of the ruinous learning conditions that too many minority youth were exposed to in primary and secondary grades. Successful pre-college programs, both academic and motivational, have increased the pool of minority students who were either qualified or qualifiable engineering students.

This approach was designed to address the key factor of academic preparation at an early stage.

UNIVERSITY LEVEL RETENTION PROGRAMS

The development of pre-college programs has not been the entire solution to the retention problem. Many of these programs succeeded in helping to prepare students academically and socially for their college experience, but not enough students could be accommodated by pre-college programs. Those programs which were comprehensive were costly and student enrollment had to be limited. Furthermore, these programs could not entirely counteract a prolonged period of deficient education. Therefore, university level support programs were and are necessary on the campuses if high enrollment, retention, and graduation rates are to be achieved.

University level support programs are not a new phenomenon. Since the late sixties, campus officials have established university-wide minority student support programs at their institutions. In some cases, these were voluntary actions, but in most cases, the programs came about through state or federal pressures. The components of these earlier programs included financial support for students and tutorial services. University level minority engineering programs (MEPs) are somewhat different than the more traditional campus-wide programs in that they are based in a specific academic unit. The support offered is more comprehensive in nature, as demanded by the more rigorous engineering curriculum. Because the programs are academically based, they leverage the fiscal, human, and physical plant resources of the engineering school.

The Retention Task Force report identified the major components of an effective MEP:

- Tutoring supplemental to that normally provided
- Advising supplemental to that normally provided
- Minority engineering student organizations
- Career guidance
- Work experiences — co-op/summer
- Pre-college summer programs — orientation/academic/motivational
- Faculty involvement in program
- Commitment of administration/faculty to program
- Adequate financial aid/scholarships
- Merit awards
- Recognition banquets and awards
- Reduced course loads when appropriate
- Academic year programs for high school students
- Diagnostic testing/effective placement procedures
- Effective first year curriculum
- Effective recruiting/admissions policies to increase overall minority enrollment
- Minority professional engineers as role models
- Extensive personal contact with students by faculty and program staff

Subsequent chapters of this Handbook will provide a detailed discussion of these components and how they influence retention.

Recently NACME conducted a study to gain further information about what works and what doesn't work in programs designed to improve student retention. Funds were provided to 11 universities and data from 40 others were analyzed. The final report indicated that three key factors in student retention were:[3]

- Monitoring of student performance and early warning of academic difficulty
- Formal interaction among the MEP, its students, and the engineering faculty
- A summer pre-freshman program to diagnose participants' academic strengths and weaknesses and to provide the assistance indicated.

Other significant findings include:

- Summer programs, even those as short as two weeks, help improve retention if they are followed during the academic year by courses with extra sessions to increase study time.
- Services provided by an MEP are more effective at increasing retention than services provided by programs designed for all students.
- Services provided by MEPs are used more often by students with strong high school preparation and accurate academic self-concept.
- Study skills courses must be more readily available and carefully scrutinized, since they are among the support services most desired by students, but least effectively delivered.
- Students who choose to study engineering because they like problem solving are significantly more likely to be retained than are those whose choice of engineering is based on future salary considerations or other similar factors.
- In addition to traditional predictors such as high school math and science grades, recruiters and admissions officers should consider previous participation in a pre-engineering program and academic self-concept in the decision to admit students.
- Minority students who attend high schools with small minority populations usually receive significantly less encouragement from teachers and counselors to study engineering.
- MEPs should assist student organizations in attracting and involving the more academically able students who have traditionally been underrepresented in them. Participation in student organizations has been shown to have a positive effect on student retention.

These findings were derived from those actively work-

ing in minority engineering student retention programs. They indicate that effective retention programs are not haphazard, but are based on careful evaluation of what works best. In periods of fiscal constraint, every effort should be made to build on what is already known rather than use trial and error methods. In fact, the primary purpose of this Handbook is to provide a resource document which can be used by those desiring to build on the available "technology."

University level retention programs have played a significant role in increasing the numbers of minority engineering students enrolling and graduating. However, we need to constantly monitor available enrollment and graduation data to assess and evaluate our progress.

ENROLLMENT AND GRADUATION DATA

When the minority engineering effort began in the early seventies, Blacks, Mexican Americans, Puerto Ricans, and American Indians comprised less than two percent of the engineers in the nation. In order to achieve parity, measured on the basis of the 1980 census data for the college-age population, Blacks would have to reach 14.1 percent of the graduates, Hispanics 7.6 percent, and American Indians 3.5 percent.

Although significant increases in enrollment have taken place over the past decade, largely due to extensive recruitment, graduation rates have not kept pace. We have fallen well short of the original National Academy of Engineering goal of a tenfold increase in minority engineering graduates by 1984. In fact, with the total numbers of engineering graduates increasing rapidly over the past ten years, the percentage of graduates from underrepresented ethnic groups has increased only modestly.

The following data from the Engineering Manpower Commission indicates the current situation:

ENROLLMENT AND DEGREES — 1983-84 [4,5]

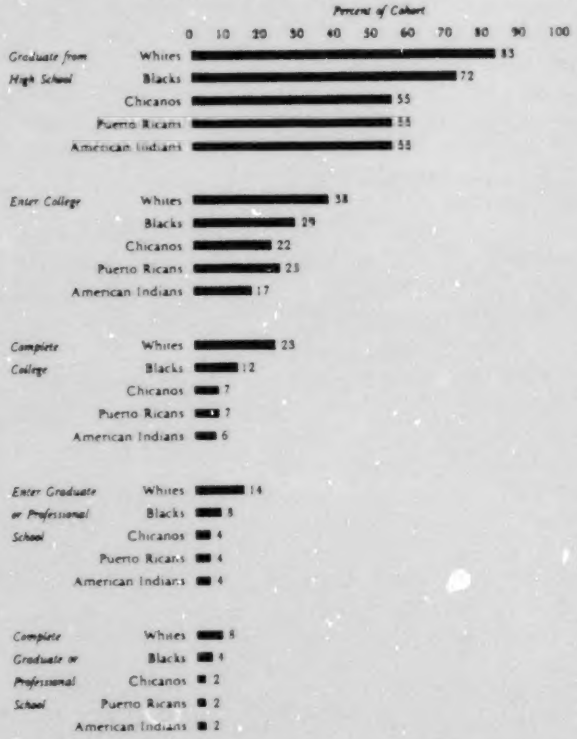
	Black	Hispanic*	American Indian
Enrollment (full-time)			
Undergraduate	17,817 (4.4%)	11,599 (2.9%)	1,127 (0.3%)
Graduate	803 (1.4%)	676 (1.2%)	53 (0.1%)
Degrees			
B.S.	2,022 (2.6%)	1,683 (2.2%)	112 (0.1%)
M.S.	253 (1.2%)	349 (1.7%)	25 (0.1%)
Ph.D.	24 (0.7%)	25 (0.8%)	4 (0.1%)

*Data does not include the University of Puerto Rico

As these data indicate, Blacks, Hispanics and American Indians comprised 4.9% of all baccalaureate degrees awarded in 1983-84 as compared to 25.2% required for parity. They constitute 3% of all masters' recipients and 1.6% of all engineering Ph.D.'s. A further significant factor shown by these data is that minorities made up 7.5% of B.S. engineering enrollment in 1979 but only 4.9% of BA graduates five years later (1983-84)[6]. This indicates that retention rates for minority engineering students nationwide are only about one-half of all students. Clearly, programs which work to improve minority student retention rates are called for.

A further indication of this need is shown in the graph below, taken from a report of the Commission on the Higher Education of Minorities:

Figure 1. The Educational Pipeline for Minorities



This shows that a substantial proportion of minority students are lost even before they complete high school; the losses continue at high rates through the undergraduate and graduate university levels. It is this latter loss which can be reduced through the introduction of MEPs.

CONCLUSION

The statistics indicate that progress has been made over the ten years since the national minority engineering effort was initiated; but we are far from reaching parity. University level retention programs have contributed greatly to the gains thus far, but the number of programs must be increased and the quality and effectiveness of existing programs must be improved. Successful models are in place; replication is the next step. The ingredients of an effective retention program are discussed in detail in this Handbook. What we need are increased human and fiscal commitment.

The following poem was used by Dr. B.A. Turner of Southern University, a recipient of the first Reginald

H. Jones Award, when describing why he continues to work with young people even though he is well past retirement age:

An Old Man going a lone highway
Came at the evening, cold and gray,
To a chasm vast and wide and steep,
With waters rolling cold and deep.
The old man crossed in the twilight dim,
The sullen stream had no fears for him;
But he turned when safe on the other side,
And built a bridge to span the tide.

"Old Man," said a fellow pilgrim near,
"You are wasting your strength with building here.
Your journey will end with the ending day,
You never again will pass this way.
You've crossed the chasm, deep and wide,
Why build you this bridge at eventide?"

The builder lifted his old gray head.
"Good friend, in the path I have come," he said,
"There followeth after me today
A youth whose feet must pass this way.
The chasm that was as nought to me
To that fair-haired youth may a pitfall be;
He, too, must cross in the twilight dim—
Good Friend, I am building this bridge for him."

Will Allen Dromgolle

This is the spirit in which we create university level retention programs so that more of our youth can span the chasm of engineering study.

REFERENCES

1. "Retention of Minority Students in Engineering," A Report of the Retention Task Force, Committee on Minorities in Engineering, National Academy of Sciences, Washington, DC. 1977.
2. Astin, Alexander, *Preventing Students from Dropping Out*, Jossey-Bass Publishers, 433 California Street, San Francisco, CA. 1975.
3. Penick, Benson E. and Morning, Carole, "Retention of Minority Engineering Students," Report on the 1981-82 NACME Retention Research Program, National Action Council for Minorities in Engineering, New York, NY. February, 1983.
4. "Engineering and Technology Enrollments Fall 1983," Engineering Manpower Commission of the American Association of Engineering Societies, Inc., New York, NY. 1984.
5. "Engineering and Technology Degrees 1984," Engineering Manpower Commission of the American Association of Engineering Societies, Inc., New York, NY. 1984.
6. "Engineering and Technology Enrollments Fall 1980," Engineering Manpower Commission of the American Association of Engineering Societies, Inc., New York, NY. April, 1981.
7. "Final Report of the Commission on the Higher Education of Minorities," Higher Education Research Institute, Inc., Los Angeles, CA. (Available from Jossey-Bass Publishers, 433 California Street, San Francisco, CA. 94104)

CHAPTER 2

A Model Retention Program

by Raymond B. Landis

California State University, Northridge

INTRODUCTION

In the last decade, successful university retention programs for minority students in engineering and computer science have emerged across the country. Although certain aspects of these minority engineering programs (MEPs) vary somewhat, the programs share common features: they are generally based within an engineering academic unit; all are dedicated to delivering services to minority engineering students to enhance their academic performance, retention, and graduation; and most attempt to accomplish a great deal with limited resources and therefore must be as cost effective as possible.

This chapter discusses both the administrative structure and the program components of a model MEP. The ideas presented here have been developed over the past twelve years not only through the examination of literature, but also through discourse and dialogue with other program directors, site visits to successful programs, and trial and error. The ideas were implemented initially at California State University, Northridge. In 1982, the California Mathematics, Engineering, Science Achievement (MESA) organization offered funds to engineering schools throughout the state to implement this model. MESA now supports fifteen MEPs that deliver services to more than 2500 students at universities throughout California.

PHILOSOPHY

Several ideas underpin the MEP approach. Perhaps the key idea is that MEPs are academically-based support programs housed in and administered by schools of engineering. Academically-based support programs have a number of advantages over the typical campuswide approach to minority student education. Because academically-based support programs are degree specific and career oriented, they can develop a high level of mutual student support, pride, and motivation. Since MEPs are of manageable size, generally serving no more than a few hundred students, a strong supportive community of students, staff, and faculty can be established. Finally, each MEP is able to leverage the fiscal, human, and physical plant resources of the engineering school. Human resources include the support and commitment of the engineering administration and the direct involvement of faculty.

The MEP approach is designed to meet the needs of students by aiding them in overcoming barriers to their academic success. Its primary purpose is to set students on their feet by taking them from where they are both academically and personally to where they need to be to become competent, self-assured, and successful in their academic pursuits. To facilitate this "transition," the program concentrates on freshman and sophomore students.

Most student support programs tend to focus on staff-to-student interaction (e.g., tutors tutoring students, counselors counseling students, advisors advising students). This approach is costly; also, program staff may frequently be overworked and thus feel that the program is having a major impact, although from the students' perspective the program may be minimally effective. The MEP model is designed to create a high level of student-to-student interaction which not only leverages staff and program resources but also enhances each student's experience on a daily basis.

ADMINISTRATIVE STRUCTURE

The California MEP programs provide an example of an administrative structure. Each program has a strong program identity and visibility. Each is called the Minority Engineering Program (MEP) and has a full-time staff director who reports to a tenured faculty member, often the dean of engineering, who serves as faculty sponsor. Each has at least one half-time staff member for clerical support and utilizes student assistants and student work-study help as office assistants, tutors, and recruiters. As programs grow and resources permit, additional staff members such as recruiter/counselors are added.

Engineering schools provide space for an MEP office complex and an MEP student study center, both adequately furnished and equipped. Each program involves faculty not only in the administration and support of the program but also in working with students as academic advisors, mentors, and counselors. Every effort is made to ensure that the program is an integral part of the engineering school and that the program's success is a high priority of the school and its administrators.

Close and mutually beneficial relations are established with industry which provides financial support, loaned personnel, summer jobs for students, and other

forms of support. Programs are encouraged to seek resources not only from industry but also from all available sources both within the institution and elsewhere. Each program is required to prepare an annual proposal to MESA for funding and to submit interim and final reports that document program performance. New students complete an enrollment form, and their year-by-year performance is tracked by use of a progress report form. Each MEP is encouraged to utilize the resources and services of other campus units such as the placement office, counseling center, learning assistance center, etc.

PROGRAM COMPONENTS

At the heart of an MEP program are those components and activities which directly affect students. Particularly important are those components which develop a community of MEP students to reduce the sense of ethnic isolation and alienation. Equally important are activities which provide students with comprehensive academic support.

The following sections provide an overview of each of the twelve components of a model MEP program. Detailed discussions of each are provided in the chapters that follow. A form for evaluating a model MEP program and setting program priorities is included in Appendix A.

The twelve components of a model MEP are:

- Recruitment
- Admissions
- Matriculation
- Academic Support
- Freshman Orientation
- Student Study Center
- Academic Advising and Registration
- Student Organizations
- Tutoring
- Personal Counseling
- Summer Jobs
- Financial Aid and Scholarships

Some of these components are more important than others, and when initiating an MEP all cannot be implemented immediately. Priority should be given to developing a sound freshman transition experience which includes assistance with matriculation and an academic year program of strong academic support and community building activities. Primary to building that community are the freshman orientation, the student study center, academic advising and registration system leading to clustering, and student organizations.

Recruitment

MEP programs must be closely involved with the recruitment of students. By active recruiting, the MEP ensures a proper match between the program and the institution and each student's background and goals. Every year MEP staff should set a target number of students to be admitted to the program. An appropriate recruitment plan should be established to build a strong applicant pool from which students are admitted and matriculated. Recruiting activities conducted by MEP staff in conjunction with university-wide outreach mechanisms typically include:

- High school and community college visits
- Mailings to high school math/science teachers and counselors
- Use of national search lists
- Field trips and career days at the university for high school students, and
- Use of regional pre-college program networks

Admissions

To make certain that new MEP students are admitted in a timely and efficient fashion, the MEP staff should work closely with the university and engineering admissions offices. This collaboration is crucial if the MEP intends to hold summer orientation or bridge programs because the admissions process must be completed before students can participate in such programs. Where appropriate, MEP staff should lobby for admissions accommodations for minority applicants and consider developing alternate academic paths for students who are not admitted.

Matriculation and Bridge Programs

Matriculation activities occur between the time a student commits himself to attending the university and the time classes begin. These activities include financial aid budgeting, housing, diagnostic testing, academic advising, registration, and orientation. If the MEP staff does not thoroughly attend to the details of matriculation, entering students can face obstacles and suffer handicaps from which they may never recover.

In individual meetings, the staff counselors should assess each student's financial status, and secure scholarships or loans if necessary. For students who must work while attending school, counselors should help to balance the student's course load and work commitment. Part-time work on campus is generally available and should be arranged whenever possible to keep the students on campus where they are more likely to concentrate on their studies.

MEP staff should also help students to find suitable housing. Where dormitory space is scarce, MEP may be able to reserve rooms for its students, and perhaps even cluster them on common floors to promote group study and interaction.

Students must be notified of appropriate math, science, and English placement tests and encouraged to take them. Although some universities require all students to start at a specific level, most have alternate tracks that permit a student to start from one to three semesters behind the required freshman engineer-

ing curriculum in math, science, and English. When the university does not administer placement tests, the MEP should establish its own testing procedures. After students have been tested, they should be advised as to what courses to take. It is crucial that students start in a program that is challenging but not beyond their capabilities. When in doubt, advisors should lean toward a lighter load for the first term.

For students whose academic preparation falls below the required freshman level, a summer bridge program can provide concentrated, intensive work to develop math and science skills. For all students, regardless of level of competency, a summer program can simulate the competitive, study-oriented environment that they will soon face. While the usefulness of bridge programs is unquestionable, the costs of bringing students together for six to eight weeks can be staggering. Where the allocation of a university's resources do not generally extend into the summer months, it may be necessary to seek grants and outside funding to operate a summer bridge program.

Academic Support

Tutoring, study skills training, and careful course selection can enhance the students' academic performance; however, other formal types of academic support may be needed. Academic support includes effective use of pre-freshman math and science courses, supplementing the early math/science instruction, and close monitoring of students' academic performance.

Often students are not prepared adequately in high school for the calculus, chemistry, and physics courses required for engineering majors. These students must complete from one to three terms of pre-freshman math and science courses. MEP staff should be intimately familiar with the various alternative pre-freshman course sequences. Where courses are unavailable or existing courses are inadequate, MEP staff should work with the math and science departments to develop new courses or to modify existing courses.

Another form of academic support is to supplement the early math/science instruction with recitations, shadow courses, or formal workshops. These supplemental activities can provide the student with additional exposure to the subject, more training in problem solving, the time to ask questions, and the benefit of group study. The Professional Development Program (PDP) at UC Berkeley, for example, has developed math and science study groups for its minority freshmen (see Chapter 8). These groups emphasize peer tutoring under the direction of a trained and experienced group leader. Groups of students, all of whom are enrolled in the same math or science course, meet regularly during a semester/quarter; they work together on homework assignments, review class material, and prepare for exams. The group leaders attend each study session, provide tutoring when needed, and encourage students to help one another.

Monitoring freshman students ensures that each is progressing satisfactorily and fully utilizing the support services provided by the MEP. Through systematic progress reports and consultations, MEP staff counselors can spot problems early and help the student to resolve them before they become overwhelming. MEP staff can also use the consultations to recognize and encourage successful students. Monitoring students' progress also yields information, both statistical and historical, that is useful in forecasting program resources and activities. Because student retention and academic performance reflect an MEP's effectiveness, scrutinizing students' progress is a top priority.

Freshman Orientation

Close contact with freshman students from the start is of major importance. Close contact and the implementation of transition activities can be assured through a formal orientation course for new freshmen. Preferably the course should be for academic credit and cover the entire freshman year.

The objectives of the course are largely non-academic and focus on motivational topics, career awareness, group dynamics, study skills development, and a thorough orientation to the university. A major focus of the course is building a strong sense of group cohesiveness. Exercises should be conducted to ensure that the students know one another and that an attitude of mutual support is fostered.

Extensive information on developing study skills should be presented, including discussions on how to approach college courses, how to take notes, how to study, how to take tests, and how to interact productively with professors. Emphasis should be placed on teaching students how to use their time effectively through scheduling, organization, and planning.

A student's commitment and motivation can be increased through discussions of the opportunities and rewards associated with careers in engineering. Role model engineers and computer scientists can speak about their experiences as students and what effects on their lives their status as professionals has exerted. Field trips to local industries can provide further insights into the world of work.

Student Study Center

Each MEP should establish and maintain a student study center. In times of resource cutbacks and scarce space, a student study center may be difficult to obtain but it is essential to an effective retention program. There are two primary purposes for the student study space:

1. To provide a place for students to study in groups, and
2. To provide a place to deliver tutorial services.

The student study complex also facilitates communication among students and provides a place where

MEP staff can reach students. Information can be posted on all MEP activities including student organizations, summer jobs, scholarships, career days, field trips, and speakers. Perhaps, most importantly, it provides a place where a student can go and always find a friendly face.

Academic Advising and Registration

Quality academic advising is a major aspect of the MEP program. The advising process should strive to ensure that MEP students are taking the proper courses, the proper load, the best available teachers, and the same sections of their classes as much as possible. One of the primary barriers which traditionally has prevented minority students from succeeding in engineering has been a feeling of alienation resulting from isolation. To be the only minority student in a difficult technical class hinders the development of relationships for both personal acceptance and academic success.

Academic advising can be provided by MEP staff or by selected faculty. Both groups require training: the staff must understand the curriculum, and the faculty needs to learn more about intercultural communication.

Quality advising is of little value if students are unable to enroll in recommended classes. MEPs should seek registration accommodations to ensure that MEP students get the classes they were advised into. Priority registration, block registration, and restricted sections are three possible approaches.

Student Organizations

Student organizations are another vital component of an MEP. Membership and participation in such societies provide students with opportunities to develop their leadership, interpersonal, and communication skills. Student organizations serve as a mechanism for social interaction and support and promote a feeling of "belonging" through the special identity that they confer.

Because of their link with industry and practicing engineers, affiliations with professional organizations are particularly beneficial. Minority organizations such as the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the American Indian Science and Engineering Society (AISES) can provide, in addition to business connections, role models, guest speakers, scholarships, and other support.

The MEP can encourage and support student organizations in numerous ways. Its office can serve as the office for the clubs; phone calls and mail can be routed there; and it can provide clerical assistance. MEP staff can serve as club advisors or faculty sponsors, and pave the way for jointly sponsored activities such as banquets, conferences, and recreational events.

The student organizations in turn can support the MEP. Student representatives can sit on the MEP's advisory board or executive committee to assist in the governance of the program. The clubs can raise funds for the MEP with contests, book/bake sales, raffles, and similar small-scale projects. The student organizations can enhance the MEP's community-building efforts by organizing mentor systems in which lower-division students, particularly freshmen, are assigned upper-division student mentors.

Tutoring

Another essential support service of the MEP is its comprehensive tutorial program. Tutoring in all lower-division math, science, and engineering courses should be available to all MEP students. Universities often tutor in basic math and science through their learning resource centers or self-instructional laboratories. Yet these services are usually inadequate for the MEP students because the tutoring needs of engineering majors tend to be more advanced than those of other university students. MEP tutoring services are also likely to be used more extensively because they are viewed by the students as an integral part of the MEP program. Students who come to the MEP for tutoring meet friends and fellow classmates struggling with the same subjects or preparing for the same exams. In this sense, the MEP tutoring program is an extension of the community that the MEP strives to build.

An effective tutoring program depends upon two important resources: tutoring space and tutors. If the MEP has its own student study center, tutoring can take place there. Otherwise, tutoring space must be found. The tutors, paid or volunteer, can be faculty, MEP personnel, graduate students, minority junior or senior students, or professional engineers. Especially important to the tutoring program is sufficient publicity so that MEP students are aware of the program's existence. The best tutoring programs can be ineffective if the students do not utilize them.

Personal Counseling

MEP students often require personal counseling. Perhaps to a greater extent than majority students, they may have personal factors which interfere with their schooling. The absence of successful models in their lives, for example, can diminish motivation and dedication. Direct and indirect effects of racism can erode their self-image and self-confidence. A strong sense of obligation to a financially needy family can distract a student from study, and the student's own financial burdens can lead to conflict between the need to work and the need to study. Certain minority women whose culture may disparage their academic success are in a double bind. Personal problems need to be confronted and resolved, and MEP staff must be prepared and willing to provide help.

Personal and academic counseling services can easily overload MEP staff. To lighten their burden, many MEPs are tapping a variety of outside sources to assist

in counseling. They often call upon a university's counseling center staff, selected faculty from the engineering school, professional engineers, and student counselors to participate in the MEP's counseling program.

Summer Jobs

Each MEP program should make a special effort to assist its students in acquiring engineering-related summer jobs. In addition to providing financial support, summer job experiences can exert a profound motivational value and can enhance a student's awareness of engineering as a career.

Most industrial firms, especially large corporations, offer special summer programs for engineering and computer science students. Many are eager to fill their summer positions with minority students. Companies also offer year-round part-time work. The companies consider their summer and part-time job programs as a means of identifying and grooming future full-time employees. The students view the jobs as an economic necessity, an invaluable experience, and a "foot in the door" to a firm for which they may want to work after graduation.

The MEP's role is to connect its students with companies that offer summer and part-time work. MEPs can do this directly or in conjunction with other university offices, such as the engineering co-op office or the university placement office.

Financial Aid and Scholarships

As the cost of education constantly rises, so does the need to secure financial aid and scholarships for MEP students. While students with demonstrated financial need can receive state and federal aid, most students must obtain additional funds. Scholarships offered by the MEP, the university, local industry, or professional organizations can provide extra income and reward a student's academic excellence. Achievement awards issued periodically by the MEP or engineering school also provide extra income plus the opportunity to acknowledge a student's superior performance.

In addition to earmarking funds for scholarships or achievement awards, the MEP can help students financially in other ways. First, the MEP staff must be thoroughly knowledgeable about financial aid sources, policies, and application procedures in order to advise the students about available loans and grants. MEP staff also must know what scholarships exist and continually search out new ones. Finally, the staff can provide related support services, such as nominating students for scholarships, helping them to prepare scholarship applications, generating letters of recommendation, and transmitting copies of transcripts when requested.

THE MEP ENVIRONMENT

The previous descriptions of the various components of an MEP program do not do justice to the most important aspect of the program: the atmosphere and environment created for and by the students. The successful minority engineering program creates an environment, a subculture within the engineering school, that mitigates negative circumstances. From the outset, an MEP student receives support and encouragement from both staff and other students. There is truly a sense of "family."

Perhaps the biggest resource of an MEP program is its junior and senior students, who provide invaluable support to younger students. Upper-division students serve as counselors, advisors, tutors, mentors, big brothers and sisters, and, most importantly, as role models. A student entering an MEP environment cannot help but be strongly affected by the large number of students from similiar backgrounds who are succeeding in their studies because of hard work and dedication.

The MEP program also helps students to fulfill their social needs within their academic environment. Negative peer pressure often detrimentally affects the performance of minority students, especially in rigorous majors such as engineering and computer science. For a student to study alone for four or five hours a night and on weekends is especially difficult when one's friends are not studying at all. Within the MEP community, however, students develop relationships with others who share common goals and similar workloads. When one's friends are all studying, studying becomes the order of the day. Personal sacrifice becomes easier when it is the norm.

CONCLUSION

This chapter has provided an overview of a model retention program, discussing program philosophy, administrative structure, and program components. It is hoped that it will stimulate a greater interest in the subjects presented so that the reader will delve further into the detailed presentations in the chapters that follow.

CHAPTER 3

Recruiting and Admissions

by Margaret E. Boulding

Case Western Reserve University

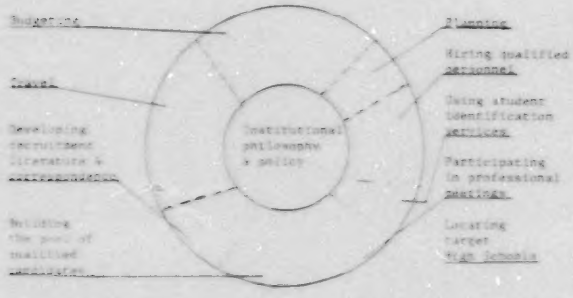
INTRODUCTION

This chapter is meant to provide minority engineering program administrators (or any other interested persons) with suggestions for recruiting economically, efficiently, and effectively. Minority recruitment can be extremely challenging because it involves locating students who have completed a good college preparatory program; identifying students who have an interest in engineering and who are ready to make a commitment to an engineering curriculum; and competing with other engineering schools recruiting from the same relatively small pool of students. It is the intent of this chapter to help minimize the stress or "burnout" associated with recruiting, and assist engineering programs in recruiting effectively in spite of the problems.

RECRUITING

Recruiting is one of the most important functions of any organization or institution. It is important because it is, in a sense, the lifeline that replenishes the membership or body of a group. In this case, we are concerned with the number, quality, and ethnic make-up of students enrolling in a school of engineering. Our concern extends beyond any given university's enrollment requirements to the fulfillment of the nation's need for engineers and scientists and to ensuring that these opportunities are offered to minorities.

We need a carefully structured approach in order to fill our engineering schools with students who will be able to graduate. Our recruiting plan should take into consideration all of the variables that will affect our task, as shown below.



Institutional Factors

First, the philosophy and resulting policies of the individual university must be clearly defined so that the recruiter understands the type of student being sought and can design an appropriate recruiting plan. The philosophy and policies of the individual university dictate the approach that will be taken in all aspects of education at that institution. They determine the standards, curricula, facilities, procedures, traditions and the type of student to be recruited. The philosophy and policies will determine whether or not the institution will provide equal access to higher education for all students and/or accept students with academic profiles that may vary somewhat from their preferred model. A highly selective institution will, in all probability, have a policy which includes provisions for accepting students who do not meet all of their selection criteria (risk students). Similarly, there should be a policy that states a commitment to accept those minorities least represented in the areas of engineering.

The above commitment to accept "risk" and minority students should be accompanied by an additional policy to provide a strong academic support system so that these students will have the highest possibility of success. Increasingly, universities have developed special counseling, tutoring and mentor programs, faculty awareness seminars, and other such services. Accepting these students without providing such support puts the students at a disadvantage from the start. This situation has been defined as recruitment failure.[1]

For effective recruitment, the institution should provide adequate funding for staffing, advertising, and travel. Unfortunately, many administrators are expected to recruit without all the necessary resources. If the director is in this situation, he or she should do two things: (1) send a report to the appropriate superior explaining the circumstances and how they will affect recruitment of students, (2) design a recruiting plan based on the resources available and submit it to the appropriate superior. That plan should include at least a large postage allowance because most contacts will be established and maintained through letters, brochures, and catalogs. At this point, the director will need a recruiter to implement the plan.

The Recruiter: The Unsung Hero

The foundation of any recruiting plan is the recruiter.

As Roger H. Hawk stated:

> He comes in all styles, shapes, and sizes. Typically he has been the person who likes people, who has the gift of gab, and who has no objection to long airplane rides, unpredictable hotel beds or substandard food at premium prices.

The recruiter is the "unsung hero" with more power than most people realize. The recruiter represents the school and its image. He or she has the power to open or close the door to the university. In many instances recruiters work out of the office of admissions; not only do they recruit, they usually are members of the admissions committee for the school. Most people think of them as small cogs in the wheel, yet they are indispensable to their employer.

Recruiters should be selected with the greatest care. Some basic qualifications are:

- ability to understand and represent the university's philosophy, policies, and admissions criteria
- knowledge of any issues related to student selection (both traditional and minority)
- knowledge of equal opportunity laws
- some salesmanship qualities
- ability to function in the midst of confusion
- ability to be impartial and nondiscriminating

The recruiter must have a clear understanding of all aspects of the university. He or she is the emissary for the institution and must be able to share all relevant information with potential students.

Recruiters also should be sensitive to the social and cultural characteristics of the particular groups from which they are recruiting. "For example, the socialization of females in the Mexican-American community is usually different from the socialization of females in the rest of the population. In line with this socialization, females are usually required to remain under the protection of the family until marriage, which means that females are not generally encouraged by their parents to enter a residential college away from home. Moreover, to leave without parental consent is a *falta de respeto* or *falta de educacion*, each a violation of proscribed behavior and a potential injury to the honor of the *familia*."[3] Thus, in recruiting Mexican American women, the recruiter must be prepared to speak with the parents and the daughter to reassure them that attending a residential college is an acceptable action. Sometimes this can be done by pointing out that a neighbor or relative has resided in a dormitory or pursued engineering.

Another example is that Blacks, like other students, are often initially impressed—positively or negatively—by a recruiter who visits their high school. The friendliness, warmth, and openness of the recruiter is especially important to the Black student, whose impression may be shaped more by the nature of the interpersonal transaction than by the content of the information about the institution.[3]

In addition, both Black and Mexican-American students are likely to be influenced by printed information which emphasizes cultural diversity, composition of the student body, special programs available to minorities, and the social and recreational activities available. They are also influenced by the attitude of the minority community toward the institution if the college or university happens to be close to their home. These are just a few of the many variables that may influence a minority student's decision about a university; there are other factors such as cost, prestige of the institution, and student-teacher ratio that are of obvious general concern. Good recruiters must, above all, be flexible and able to change their approach to fit the interests and values of the various cultural and ethnic groups they address.

Sources of Students

A recruiter must know where to find the pool of students best suited for the institution, and also how and when to advertise. When looking for students to enroll in a school of engineering, recruiters should begin with the resources in their own university. Practically every admissions office has a list of high schools considered to have particularly strong mathematics and science programs. They should send literature to those schools and plan to make visits if the budget permits. If a visit is not possible, telephone recruiting is a good approach because it offers some degree of personal contact. Recruiters should develop a list of target people to call (e.g., teachers, counselors, minority engineering program administrators, etc.), and brief them over the telephone.

Next, the recruiter should move to outside resources. Using student location lists, such as those provided by the agencies listed below, is helpful.

American College Testing Program (ACT)
2201 North Dodge Street, P.O. Box 168
Iowa City, Iowa 52243

College Entrance Examination Board (CEEB)
888 Seventh Avenue
New York, New York 10019
Note: The CEEB provides lists based upon students' performance on the Preliminary Scholastic Aptitude Test (PSAT) and the Scholastic Aptitude Test (SAT).

National Action Council for Minorities in Engineering (NACME)
3 West 35th Street
New York, New York 10001
Telephone: (212) 279-2626

National Scholarship Service and Fund for Negro Students (NSSFNS)
1501 Broadway
New York, New York 10036

Who's Who Among American High School Students
Educational Communications, Inc.
721 North McKinley
Lake Forest, Illinois 60045

NACME has arranged for the CEEB and ACT to compile lists of minority students who have taken the college entrance exams (PSAT, SAT, and ACT) and distribute these lists upon request. Requests should be sent to the ACT and CEEB at the above addresses.

Another way to identify potential engineering students is to contact professional engineering organizations. Local chapters of these organizations may run engineering exposure programs for junior high and high school students, and they may be aware of students who possess a strong interest in engineering.

The attempt to increase the pool of minority applicants for schools of engineering is a joint effort shared by the public schools, the National Association of Minority Engineering Program Administrators (NAMEPA), the National Association of Pre-College Directors (NAPD), industry, parents' groups, and a number of other organizations. It is wise for a recruiter to join these organizations or establish contacts within them. All of these groups provide programs and activities to motivate minorities to take mathematics and science courses so that they will be prepared to pursue engineering if that is their desire. Many of the students involved in these programs will obviously be prime candidates for admission into engineering school.

Although all of the above groups are important, a recruiter will probably acquire most applicants through his high school contacts and through the pre-college minority engineering program directors. The other groups will contribute primarily toward building the overall pool.

The recruiter assigned to recruiting minority students should do the following:

- Identify the geographical locations that have a large minority population. (Currently, the largest pools of Black students are to be found in the South and the urban areas of the Northeast and Middle West with smaller groups in the states west of the Mississippi River, according to Jewelle T. Gibbs.[3] She further indicates that population size is not a sufficient indicator of Black student availability. The pool is influenced by the interaction of family socio-economic status, high school educational facilities and previous interracial experiences.);
- Identify the states that have the largest number of students already attending the recruiters' school;
- Identify the target schools that have strong academic programs in mathematics and science;
- Visit community colleges. They are an excellent source of students with a high potential for success. These students have taken some college-level course work, which should prepare them for a highly competitive school;
- Contact existing national organizations (NAMEPA, NACME, etc.) to obtain lists of pre-college and college minority engineering programs and lists of qualified students;
- Develop a working relationship with directors and staff of minority engineering programs.

Other outreach activities should include high school visits, special engineering and science programs on the university campus for high school students, teachers, counselors, administrators and parents; involvement in alumni groups and their programs, and science fairs and career days at target high schools and at your university. The special events, such as high school visits and career days, are crucial because they provide an opportunity for the recruiter to talk in person with a large number of students. This interpersonal contact is especially important since most students respond favorably to a recruiter who is warm, friendly, and interested in their needs.

Career days are designed to introduce students to a variety of careers through personal presentations or demonstrations by people engaged in many different kinds of work. There may be a speaker each week, field trips to companies, or an extravaganza where many professional people come to the school to talk and/or provide demonstrations. Whenever possible, a recruiter should participate in these activities. They are a good opportunity to make valuable contacts with students as well as educators and professionals who may be able to assist with recruiting.

High School Visits

High school visits should be carefully planned. Most high school administrators are protective of their schools, and they cautiously screen the people who want to give presentations to their students. Therefore, the recruiter should go through the proper channels to gain access to the schools and the teachers who are able to help in the search. (Each school system will have its own protocol for this process.) General steps to be followed are:

1. Obtain permission from the principal (or a designee) to visit the schools, teachers, counselors, etc.
2. Develop a close working relationship with teachers and counselors by getting to know them in the classroom, meeting them for lunch, etc.
3. Work with teachers and counselors sensitive to minority issues and willing to help. (You may get to know these people through referrals or through trial and error.)

4. Develop a good rapport with the teachers by taking time to share literature about the minority engineering effort and why it is important. Explain to them how and where they can obtain free literature about engineering from our industrial contacts; let them know that NACME and certain professional organizations provide a list of workshops given by university faculty to share information about the engineering and science disciplines.

5. To improve relations with the high schools, develop a math and science tutoring program for their students, employing your college engineering students as tutors. Hold some tutoring sessions at the high schools and others at the university.

6. Notify teachers, counselors, administrators and students of career days offered at your university to inform students of opportunities in the engineering field.

7. Develop methods of follow-up, such as phone calls to students and parents, informational letters, etc.

Recruiting Through Pre-College Programs

In the mid-1970s, the Alfred P. Sloan Foundation invested approximately $15 million primarily to create a network of regional pre-college programs across the nation. The objective of these programs is to increase the number of underrepresented minority students graduating from high school with the proper math, science, and English preparation and the motivation to pursue the study of engineering.

Over the past ten years, many of the programs initiated with Sloan funding have grown and prospered, and new ones have been formed. The better known include SECME in the Southeast, MESA in California, PRIME in the Philadelphia area, TAME in Texas, and MASS-PEP in Boston. These regional pre-college programs form the National Association of Pre-College Directors (NAPD).

These programs represent an excellent recruiting source since they can provide access to students with strong math/science preparation and an interest in engineering. NACME in New York (Telephone: 212-279-2626) can provide information as to how to contact NAPD or specific regional pre-college programs.

The Role of the Minority Program Administrator in Recruiting

Like recruiters, minority program administrators should develop good working relationships with teachers, counselors, parents, industrial representatives and students. They also must serve as counselors, teachers, and surrogate parents to the students in their programs. Therefore, it is quite natural for them to assume the role of recruiter and counsel the students with whom they have worked over the years. A good minority program administrator will meet with parents and pre-college students to discuss the selection of the most suitable engineering school for the individual students. This means that the administrator shares all of the information (e.g., philosophy, cost, etc.) that he has about his own institution and others appropriate for the students.

Another responsibility of minority program administrators is to be fair and honest in providing information to minority students about their university and others. For example, is there a retention program for the non-traditional student? Does the retention program include some type of bridge program in the summer prior to the student's matriculation at the college? Is there a support system after school begins (e.g., study laboratories, tutors, group study or scholarships)? All of these items are essential to the success of many minority engineering students. Often students cannot see the value of these programs at the time when they enroll in highly competitive schools. If they have performed well in high school, they feel confident they can survive in any college. They may struggle through the entire first semester before conceding that they could use some help.

The best assistance a minority program recruiter or administrator can offer students who seem reluctant to participate in a retention program is to explain and promote the program's services prior to the students' matriculation. It is also useful to make sure that this information is given to the parents. With the parents' help, an administrator or recruiter may convince students to utilize these valuable services before they become discouraged or fail.

THE ADMISSIONS PROCESS

Locating and identifying potential engineering students among minorities is only the beginning. The next step is to help them gain admission into the institution. The minority engineering administrator and the recruiter should work together to admit the students.

Most colleges have developed admissions criteria in an attempt to predict students' success after matriculation. People who have had limited exposure to minority students may have problems interpreting and evaluating their data, especially their standardized test scores. Students' futures are frequently controlled by a system that is subjective and often based upon misleading information. Often these tests do not accurately reflect minority students' abilities because they are based on the anticipated responses of traditional students. These most commonly used predictors of college success are: (1) students' high school academic records; (2) social or demographic data—students' life histories; (3) standardized test results (SAT, ACT, etc.); and (4) a comparison of student characteristics with those of the institution. There is merit in all of the above approaches; however, they are most effective when applied in combination.

It is appropriate to require of a student seeking ad-

mission to an engineering college that he or she should possess particular talents and abilities. In addition, the student must have:

(1) performed well in high school (especially in mathematics and science) and on college entrance examinations,

(2) participated in extracurricular activities,

(3) obtained good recommendations from teachers and/or counselors.

In short, the applicant has to be nearly perfect.

When either a minority or a "traditional" student happens to fall short of one or two of the requirements, he or she becomes a "risk candidate" for the highly selective schools and could be rejected. Determined students may counteract a rejection by opting for a personal interview when possible. It gives them the chance to talk to the admissions committee and explain what happened (working after school, illness, or personal problems with the family) to bring about the shortcomings.

The recruiter also should advise minority applicants to obtain good personal recommendations. Students should be warned to be very selective in choosing the people they ask to write recommendations for them. They should avoid asking teachers and counselors who may not have had a chance to get to know them well, or who are too busy to take the time to produce a thorough and well-written statement.

It is helpful for recruiters to work within the system to (1) convince the members of the admissions committee to consider all the information included in the minority students' applications and pay close attention to the recommendations; (2) encourage the admissions committee to place less emphasis on standardized test results; and (3) form a special review committee for high-risk minority applicants. This committee should be comprised of people who are sensitive to minority issues and problems. They might conduct personal interviews and talk to the individuals who have worked closely with the applicants. The committee could also help to keep a close watch on the application process for minority students. Often high schools are slow in sending necessary information and in completing the application packet. Committee members could send follow-up letters or make telephone calls to hasten the process.

Financial Aid

Finally, an important attraction for our target students is financial aid. Although most students require some financial assistance, often financial aid is the deciding factor in a minority student's college selection. And although recruiters do not establish financial aid policies, they should do what they can to promote the development of merit scholarships and grants for minority engineering students. If this kind of assistance is made available at their institutions, they will find it much easier to recruit well-qualified minority students.

While it is not the recruiter's responsibility to develop or implement all of the programs and procedures that are here proposed, he or she is in a position to make suggestions to the people who do establish policies. He or she also has a knowledge of the special circumstances surrounding minority students (which other administrators are less likely to be aware of). If an institution has a genuine commitment to increasing minority enrollment, the recruiter's ideas should be well received.

Working to Increase the Show Rate of Admitted Students

All students admitted to a university may not choose to attend that institution. In an effort to convince accepted students to come, the recruiter may want to do the following:

(1) Telephone the students and then parents (if a visit cannot be arranged) to reconfirm all of the strengths of the university, its faculty, curriculum, and social and cultural activities;

(2) Develop programs for students and alumni, such as having upperclassmen from a prospective student's home town contact him or her to share their positive experiences at the university;

(3) Continue to send the university's publication and activity schedules to the student.

Marketing has become an integral part of recruiting. If recruiters want their school to remain competitive, they should use one of the main activities that our Marketing Research Group has suggested— that is, the provision of information. The task is not to "sell" the students, but to inform them of all the positive aspects of the institution; then the students can decide for themselves.

CONCLUSION

Once again: the statements made earlier warrant repetition. For a program to reach its enrollment quota, it must have:

(1) a good recruiter and effective administrators

(2) a good recruiting plan

(3) a realistic budget

(4) a good understanding of the declining traditional student market and the new target student groups

(5) a good understanding of the university and its current situation

(6) a willingness to work within the institution to promote positive changes in the areas of admission, financial aid, and student services.

By focusing on these key issues and areas, program administrations should be able to develop a successful recruiting program.

REFERENCES

1. Browne, Lee. F. "Midpoints vs Endpoints, Recruiting and Admissions vs. Retention and Graduation," California Institute of Technology, Pasadena, CA. November, 1980.
2. Laury, William, R., *et al*, *College Admissions Counseling*, Jossey-Bass Publishers, San Francisco, CA. 1982.
3. Gibbs, J.T. "Black Students at Integrated Colleges: Problems and Prospects," in C.V. Willie (Ed.), *Black, Brown, White Relations*, Transaction Books, New Brunswick, NJ. 1977.

CHAPTER 4

Matriculation and Summer Bridge Programs

by Ronald L. Glenn, University of Pittsburgh
and
Raymond B. Landis, California State University, Northridge

INTRODUCTION

Many schools of engineering admit talented minority students even if they do not meet all of the usual requirements. Not only must these students often compete with better prepared students, minority engineering students may have cultural and social perspectives quite different from those of the majority students at the same institution. Because of these factors, minority engineering students can benefit from a well-planned, systematic program that enables them to make the transition to college life. While this transition may last through the freshman year and even longer, it should begin during the matriculation period in the summer prior to the start of the students' first academic year.

Matriculation is the period between the time a student accepts an offer of admission to the institution and the time classes begin. In this interim, essential activities must take place: the student must find housing, make final arrangements for financial aid, and undergo diagnostic testing, academic advising, registration, and orientation to the university and to the minority engineering program (MEP). This is also an ideal time for students to strengthen their academic preparation, if necessary.

The matriculation period is extremely important to an MEP because it sets the foundation for the working relationship the students will form with members of the program staff. Much of the work of the MEP involves helping students understand that admission does not automatically resolve such major issues as housing and financial aid and that the students must initiate their participation in such matriculation activities as summer orientation, academic bridge programs, and early registration. Students must quickly learn what they must do if they are to benefit fully from all the university can offer them.

This chapter discusses the general objectives of a matriculation program and some administrative considerations, and presents several matriculation program models including: a short (two-day) orientation program; an intermediate (two-week) orientation program; and a lengthy (eight-week) academic bridge program. These examples are meant to aid MEPs in designing a matriculation program appropriate to their institution, the specific needs of their students, and the availability of resources. Wherever possible, the MEP should make use of matriculation activities the university provides for all students.

OBJECTIVES OF A MATRICULATION PROGRAM

The matriculation process is extremely important to the students' ultimate success or failure. Students who do not make a successful transition can face obstacles which they never overcome. They may be hampered by inadequate financial resources, unsatisfactory living situations, enrollment in courses which they have little or no chance of passing, and their own unrealistic attitudes and expectations about engineering study.

In order to counteract these obstacles, the objectives of the matriculation program should be to ensure that MEP students are:

- properly housed
- adequately financed
- tested, advised, and registered in courses for which they are academically prepared
- given an orientation to the university and to the MEP

Each of the objectives is discussed in the following sections.

Housing

Housing situations vary greatly, from urban institutions which may have little or no university housing to universities that require all freshmen to live on campus. If feasible, MEP students should be encouraged to live on or near the campus so they can become fully immersed in the academic community. When students live at home, the absence of a quiet study place, distractions from parents, siblings, and neighborhood friends, and the time and energy spent commuting can have a negative impact.

The MEP can assist students in finding suitable housing. Where dormitory space is tight, the MEP may be able to reserve rooms for its students. The MEP staff can also suggest that new students pair up as roommates, or even arrange to cluster MEP students on common floors in order to promote group study and interaction.

Financial Aid Budgeting

Although the primary financial aid budgeting is the responsibility of the financial aid office, MEP staff can play a role in ensuring that students are adequately financed. MEP staff should meet with each student to assess their financial situation. Generally, students who do not qualify for adequate financial aid will be required to work part-time. Where possible, scholarships administered by the MEP (such as NACME scholarships) should be used to reduce the workload of students whose academic performance is likely to suffer. MEP staff should advise students who must work to reduce their courseload appropriately. Chapter 12 discusses the role of the MEP in obtaining adequate financial support for its students.

Testing, Advising, and Registration

Testing, advising, and registering students when they enter is extremely important; this subject is discussed in detail in Chapter 10. Due to its importance to the matriculation process, the key ideas will be reviewed here.

The first semester or quarter of a student's university experience is perhaps the most critical. The courses in which the student enrolls must be selected carefully. If they are too difficult, the student may lose confidence; whereas if they are too easy, the student will not get into the habit of studying. Poor teachers can turn the student off, and ethnic isolation can cause the student to feel alienated and out of place. It is therefore necessary to ensure that the students are taking the proper courses, have the proper load, the best available teachers, and are clustered to the extent possible in common sections of their classes.

Diagnostic tests in mathematics, science, and English can determine at what level students should start in these subjects. Where these tests are administered by the university, the MEP merely needs to make certain students take them. If testing is not otherwise available, the MEP can create and administer diagnostic tests. In addition, the MEP may wish to administer a test to assess the entering students' attitudes, values, and personal situations. An example of a student assessment questionnaire can be found in the appendix to Chapter 6.

After testing, the student should meet with an advisor. The advisor and the student should agree on the courses for the first term that are consistent with the student's ability. The advisor should go over the student assessment questionnaire, emphasizing any areas that may interfere with the student's academic performance. In some cases, further counseling may be indicated.

The MEP should see to it that the students are successful in registering for the classes they were advised to take. This may be as simple as making sure that students participate in an early registration option available to all new freshmen. If new freshmen do not automatically receive registration priority, the MEP can request special consideration for its students. Approaches include seeking priority registration or block registration, or arranging for all or part of sections to be reserved for MEP students.

Orientation to the University and MEP

The summer provides an opportunity for the new MEP student to experience college life while not yet under the pressure of the normal academic year. Regardless of the length of the summer program, some time should be devoted to orienting the students to the university, to engineering study, and to the MEP.

A thorough orientation to the university can increase the likelihood of students participating fully in campus life and using all of the available campus resources. A guided tour of the campus can be informative. However, exposure to campus facilities and services can be made more enjoyable by structuring games in which small groups of students are required to obtain information or materials from specific campus offices. Where time permits, more comprehensive exposure to key campus facilities and services such as the library, learning assistance center, counseling center, and student health center can be accomplished through presentations and tours. Rap sessions with continuing MEP students can effectively provide student perspectives on campus life.

A summer program can give new students an early exposure to the rigors and expectations of engineering study. Activities can range from presentations and workshops on academic policies and study skills to sample lectures from freshman math or science courses. Again, continuing MEP students can share their experiences, successes, and failures.

A summer program represents the students' first exposure to the MEP. So that the students may develop a positive attitude toward their participation in the program, it should be explained thoroughly. The new students should have an opportunity to meet the MEP staff. Most important, the process of building the new MEP freshmen into a supportive group should begin at this time.

Academic Preparation

The summer prior to the students' freshman year is an excellent time to bolster the students' academic background. In addition to providing the students with a headstart, it will give them a chance to adjust to the experience of being in college classes prior to the start of a full academic courseload.

Formal academic work commonly known as a bridge program is essential if high school has not prepared the student to begin the lowest math/science courses offered by the university. Even if the university offers pre-freshman level math and science courses, summer academic work may be desirable so that the student

can begin the fall term with the calculus, chemistry, and physics courses required for engineering majors.

In order to accomplish any significant amount of academic work, summer bridge programs should last six to ten weeks. The cost of such a program can vary greatly, depending on whether the students live on campus. Residential programs of this length are extremely expensive. Urban universities which recruit students primarily from the immediate area can eliminate the cost of food and housing by having the students commute.

Another consideration is whether or not to offer academic credit for courses taken during a summer bridge program. One argument is that if the students are prepared to take courses for credit, they do not need a bridge program. If credit is given for pre-freshman math/science courses, it should be made clear to the students that these courses do not meet engineering graduation requirements.

A well-designed summer bridge program should emphasize basic work in mathematics, chemistry, and physics, since these courses form the foundation of the engineering curriculum. The mathematics work should strengthen the students' foundation in algebra, trigonometry, and analytic geometry. This is of benefit even to the student who has taken a great deal of mathematics in high school. University mathematics professors commonly complain that high school mathematics courses have taught the students shortcut rules for the manipulation of formulas without developing an understanding of fundamental principles. Because of the pressing need to strengthen the students' foundation in algebra, trigonometry, and analytic geometry, the temptation to offer brief, watered-down versions of calculus should be resisted.

The chemistry and physics courses should emphasize fundamental problem-solving skills. Most important is the ability to solve "word problems." Students need to learn how to dissect word problems and how to develop orderly procedures for their solution. It should be noted that the skills needed in chemistry are somewhat different from those needed in physics. In physics, there is a direct correlation between student success and the strength of the mathematics background: the primary problem for students is learning how to construct the appropriate mathematical formula from the word problem. Then, if the student is sufficiently proficient in mathematics, the rest of the problem is mostly a matter of the manipulation of the formula. Chemistry, on the other hand, most often has no set formulas. Instead, a student is expected to proceed from some fundamental definitions and concepts to a solution to the problem by an orderly process. Seldom does the solution to the problem depend on complex mathematics and equally seldom is the solution simply a matter of selecting and manipulating the proper formulas. Chemistry at the elementary level asks the kinds of "what if" questions that scientists and engineers most often have to answer in their advanced classes. Consequently, some summer program instructors have found a high correlation between success in chemistry in the summer and success in other science and engineering courses in the fall.

Most summer bridge programs offer a course that introduces the students to basic engineering principles. Generally, this course should provide an overview of engineering, not an in-depth study of engineering topics.

The summer bridge program should emphasize written and verbal expression, perhaps in a course on writing. Not only should such a course stress correct grammar and structure, it should also train the student to write persuasively and effectively. For these purposes, problem-solving workshops that emphasize word problems, written reports and group discussions can benefit the student.

Summer bridge programs should not, however, preview material the students will be repeating during the academic year. If the material in their fall courses seem too familiar, they often fall into a trap: they become overconfident because they think that they know this material very well. As a result, they may not study seriously and may find themselves performing at a less than satisfactory level. If the purpose of the summer bridge is to give students a head start in a particular course, a different textbook should be used, so that the material presented during the fall term will seem to be new and interesting.

ADMINISTRATIVE ISSUES

Implementing an effective matriculation program requires detailed attention to a number of administrative matters. Communication with the student must be established early. A plan for close coordination with the university matriculation activities must be developed. The length and scope of a special MEP orientation or summer bridge program must be determined. Each year the program should be evaluated so that it can be refined and improved.

Establishing Communication with Students

Matriculation cannot begin until the admission process is complete. The recruiting and admissions process is discussed in more detail in Chapter 3. However, a few points should be mentioned here. The admissions letter should clearly indicate the steps that a student must follow to complete the enrollment procedure. In addition, this letter should briefly introduce the MEP, answering such questions as whether admission to the university is contingent upon participation in the MEP or whether participation in the MEP is optional. A letter from the MEP director should follow soon after, giving a detailed description of the program as well as names, addresses and telephone numbers of MEP staff members and any other contact persons, such as a faculty advisor. This letter can clearly

delineate the role of the MEP in the matriculation process.

It is not enough merely to state the role of the MEP in letters to the student. For the student to see that the program is valuable, the next communication should be a letter or telephone call from an MEP counselor or advisor. This personalized communicaton is likely to have a large influence on the student, indicating that the MEP will provide a high level of personal support. A separate letter to the parent or guardian can also help clarify the benefits the MEP can provide to the student.

University Orientation

Most institutions have orientation sessions for all new students. These sessions usually include placement testing, academic advising, course registration, and a general introduction to the campus academic and social life. The MEP should make every effort to tie its orientation into the regular university orientation. Having MEP students participate in the university's orientation program reinforces the fact that they are part of the regular university structure.

Program Format and Length

A matriculation program can be structured according to various different formats and lengths. In designing a program to meet the needs of a specific institution, perhaps the primary consideration is the background and academic preparation of incoming MEP students in relation to that of all new engineering students and in relation to the expectations of the institution. Another consideration is the scope and duration of summer orientation and academic bridge programs offered by the university to all students. Still another consideration is whether the students are local and can therefore commute to the program. And of course the amount of resources available will have a major influence on what type of summer program will be possible.

The MEP's matriculation program can range from merely ensuring that incoming students take full advantage of the matriculation process offered by the university for all students to conducting a summer-long residential bridge program with a strong academic focus. The length of any MEP summer program can range from a one-hour meeting orienting students to the MEP while they are on campus participating in a university orientation to a ten-week residential experience.

A one-hour meeting is obviously too short to accomplish the essential objectives of a summer orientation and the summer-long academic bridge may be too costly. A residential program lasting several days which "piggy-backs" on the regular university orientation may be a reasonable compromise. This type of extended freshman orientation program provides adequate time for seminars, lectures, survival workshops, and presentations on engineering. Some abbreviated coursework might be included. For example, where identifiable gaps in the mathematics background of the students are identified, an intensive review of specific topics can be provided. During the orientation, as another option, students can be taught to use the university's computing system. Since entering students often lack a solid understanding of engineering as a field of study and a profession, presentations and discussions on the various engineering majors and the opportunities and rewards associated with careers in these areas can be included. Perhaps most important, by being together for several days and nights without the pressure of the academic year, the MEP freshmen will get to know each other and begin to develop a supportive community.

It should be emphasized that there are some circumstances under which a bridge program, particularly a lengthy one with a strong academic component, will be unnecessary. For example, where an institution offers many levels of pre-freshman math/science courses so that students regardless of academic background can take appropriate level courses for credit as part of the regular institutional curriculum, only a brief orientation may be required. When minority students as a group show no significant academic or social differences with respect to the larger student body, there is no need to require them to attend a summer bridge program just because they happen to be minority students.

Program Evaluation

The MEP should periodically evaluate the effectiveness of its summer orientation or summer bridge program. The evaluation should include pre- and post-tests in all course areas, assessment of students' performance by instructors, and assessments of instructors and the program by students. Later, the performance of bridge program students in their fall term courses can be compared to that of students with similar academic profiles who did not attend the program. This comparison is perhaps the most revealing test of the value of the summer program.

MODEL SUMMER PROGRAMS

As discussed in previous sections, each summer orientation or summer bridge program should be tailored to meet the specific needs of the university and its students. The following sections present several examples of successful summer programs, each designed for the student population at a particular university.

USC Minority Pre-Engineering Summer Schools

The University of Southern California (USC) Minority Pre-Engineering Summer School runs every Saturday during June, July, and August. Students who will be entering USC as engineering majors in the fall, students who were turned down for admission to engineering but were admitted to the College of Let-

ters, Arts, and Science and hope eventually to change their major to engineering, and selected students who are between their junior and senior years in high school attend. Although the program does not provide for students to live on campus, two-thirds of entering minority freshmen attend. Some commute from more than 100 miles away and some move to Los Angeles for the summer to participate in the program.

Each student takes the equivalent of two 4-unit courses, one in mathematics and the other in science. The morning (3-3½ hours) is devoted to mathematics. Depending on their prior academic achievement and their score on a placement test, each student takes either freshman calculus, high school level calculus, or pre-calculus. In the afternoon (2½-3½ hours) each student takes either freshman physics or chemistry or high school level physics.

During the 1½- to 2-hour midday break, the MEP director conducts an orientation class covering subjects such as study skills, curriculum and course selection, and minority engineering student organizations. At the end of the afternoon class, the instructors are available to help the students individually.

The math and science instructors are upper class or graduate MEP students. Since they are volunteers, the cost of the program is extremely low. Students pay no tuition, but they must pay for their books and parking, although they can defer payment until they receive their financial aid in the fall. Because the program is on Saturday, classrooms and other space to conduct the program are easy to obtain.

The summer program has clearly shown that the participants benefit. None of the engineering majors who completed the summer program over the past two years has been in academic difficulty. Many were able to start at a higher level of math and science than they would have otherwise and some were able to skip first semester calculus entirely. Through the summer program, the students were able to experience college level courses, texts, and study requirements before the start of the regular school year. Furthermore, they were able to meet and make friends with other USC engineering students, which helped them adjust to college life once the academic year began.

UCLA Summer Programs

The Minority Engineering Program at UCLA offers its new students a variety of summer academic enrichment and orientation programs. These include a six-week math/English skills building program, a four-day combined MEP/university-wide orientation, and a two-week pre-enrollment instructional program. Depending on their academic background, students may participate in more than one of these programs.

Each new MEP student is tested in mathematics and English, and students who are deficient in either subject are encouraged to attend a six-week residential academic program administered by the university-wide Academic Advancement Program. Low income students may attend at no cost, but others must pay a fee of $700. During the program, MEP students meet weekly with an MEP counselor who identifies problem areas, provides assistance with housing, reviews the students' financial aid, reviews general education and engineering degree requirements, and helps plan the students' fall schedule. As part of the program, the student receives a thorough orientation to the university and is able to register early for the fall quarter.

In late summer, the MEP conducts a one-day orientation in conjunction with the regular three-day residential university orientation. All incoming MEP students attend the one-day MEP orientation, and those who did not participate in the six-week summer program remain for the three-day university orientation. The purposes of the MEP orientation are to describe the program and its services so that students will want to be actively involved, to give students critical information regarding the School of Engineering and UCLA minority engineering student organizations, to recommend instructors and sections so that MEP freshmen will be clustered in their key math and science courses, and to identify specific problems related to financial aid and housing. The orientation provides an opportunity for new MEP students to get to know each other and to meet MEP staff and selected upperclass students. During the day, several student panels are conducted so that upperclass students can share their experiences with new students. The curriculum and the advising process are explained and specific sections of mathematics and chemistry are recommended. At the end of the day, the students take the math/chemistry placement test.

During the next three days, the students participate in a university-wide orientation program. They receive a thorough orientation to the university, meet with an advisor to finalize their fall quarter courses, and register. The orientation to the university includes a tour of campus facilities and numerous workshops covering such topics as degree requirements, academic survival, roommate relations, sports at UCLA, financial aid, student government, and fraternities and sororities. Students meet in small groups with counselors who conduct exercises to assess the students' attitudes and motivation and to identify problems that could interfere with the students' academic performance. A number of social events such as barbecues, dances, and movies are offered. Each student meets individually with a counselor who is knowledgeable about the engineering curriculum and has been oriented by the MEP to work out their course program for the fall quarter.

In addition, all MEP students are required to participate in a two-week pre-enrollment instruction program. This is an intensive program of instruction in mathematics, chemistry, and problem solving held just prior to the start of the fall quarter. The courses, taught

by department teaching assistants who follow the actual course syllabus, stress problem solving, homework, and quizzes. The purpose of the program is to provide the students some lead time to identify and address areas of weakness by previewing the first two weeks of the courses they will be taking in the fall quarter. By gaining a two-week head start, students are better able to adjust to the academic rigor of the university. Most students commute, but students from out of the area are provided with dormitory accommodations.

California State University, Northridge MEP Orientation

The Minority Engineering Program at California State University, Northridge, conducts a three-day, two-night residential summer program to orient, advise, and register all new MEP freshmen. The program is scheduled to coincide with the university's freshman orientation program for engineering and computer sciences majors, so that a number of activities common to the two programs can be dovetailed.

The first day of the MEP summer program focuses on orientation. The students arrive at the campus in midafternoon and check into the dormitory. The program begins with an early dinner followed by campus tours, MEP staff introductions, "get-acquainted" exercises, a panel of MEP students discussing their experiences, and an informal question-and-answer period.

On the second day the students participate in the university-wide orientation program. They receive orientation booklets and registration information packets, and they attend a large introductory meeting to learn about the university's general education program, the registration process, graduation requirements, and similar kinds of information. The students then go to a separate MEP advising and planning session, where they learn about specific engineering/computer science requirements and begin to plan their fall programs. During this session, which takes the largest portion of the day, the MEP staff works with the new freshmen individually and in groups to help them select their courses for the fall and plan for future semesters. Assisted by upperclass MEP students, staff members make sure that the freshmen build into their schedules the mandatory MEP orientation course, appropriate mathematics courses and their accompanying MEP math workshops, and other first-year required courses. At the same time the staff determines that the students are not setting up impractical or overly demanding courseloads.

In the late afternoon, the students take a break to hear lectures on such topics as "computer science as a major" or "college level mathematics." These talks both inform the freshmen about topics of relevance and interest and introduce them to faculty and MEP staff members. Following the lectures is dinner, and then a final meeting to finish program planning and advising. In this last session, the MEP staff and student assistants work individually with the new freshmen, making suggestions, and approving programs for the next day's registration. The day concludes with social and recreational activities such as swimming, volleyball, basketball, and casual rap groups.

The third day is for registration. After breakfast, the MEP freshmen join the other students in the university-wide orientation program to register for their classes. Because they register early, students seldom face the problem of closed classes or last-minute schedule changes. With their registration completed, the students return to the dormitory to check out, and the MEP orientation ends with a farewell luncheon.

University of Oklahoma Summer College Skills Development Program

The University of Oklahoma conducts an eight-week Summer College Skills Development Program for American Indian high school graduates and junior college transfer students planning to major in engineering.

Participants are recruited from a broad range of tribal affiliations and geographical locations. Packets containing information about the program are sent to all Oklahoma high schools and to selected out-of-state high schools. Press releases on the program are issued in Oklahoma and nationwide to American Indian publications. Past participants in the University of Oklahoma "Introduction to Engineering" program for American Indian high school students are heavily recruited.

The program has a strong academic focus on mathematics and English. Based on their high school math background and ACT math score, each participant is placed in a regular university math course, either college algebra, analytic geometry, or freshman calculus. In order to challenge the students, those whose test scores are borderline are advised to take the higher level course. The students are required to attend supplemental math workshops for a total of five hours a week.

Each participant also enrolls in freshman English composition. The students are placed in a special section which, in addition to aiming at raising their writing skills above a standard level set by the English department, is designed to accommodate the linguistic patterns typical of many American Indian writers. At the beginning of the summer program, students take the Nelson-Denning Reading Test and the Scott-Foresman Diagnostic Writing Predictor Test. Students also write an essay that is used to measure their writing proficiency. At the end of the summer program, students again take the two tests and prepare a second essay. These results provide a basis for assessing the effect of the summer program on the students reading and writing skills.

In addition to the academic focus, the program includes orientation sessions and workshops designed

to aid the bicultural students in adjusting to college. Facilities available on campus for minority students are described and academic "etiquette" is explained and discussed. Staff members help the students define themselves culturally and discuss what role they can continue to play as members of a unique culture. Discussions focus on how students can retain their cultural identity and at the same time integrate themselves into a predominantly white university and ultimately into a predominantly white business world. In the English composition course assignments also focus on cultural heritage.

Carnegie-Mellon Action Project Summer Bridge Program

The Carnegie-Mellon Action Project (C-MAP) offers a rigorous five-week residential academic experience to incoming minority freshmen. The program begins in late June, and the students attend classes six and one-half hours per day with problem-solving tutorial sessions in the evenings.

The summer courses are designed to review thoroughly high school level material and to introduce some of the new topics which will be covered in the fall semester. A typical schedule for engineering and science students is:

9:00 — 11:45 a.m.	Mathematics Chemistry
1:00 — 4:30 p.m.	English Physics
5:30 — 9:00 p.m.	Seminar Tutorial Program

To aid students in learning to work together and support one another, student study groups are formed to work on class projects, plan seminars and identify potential speakers. Invited speakers from the faculty, administration, and industry help students focus on their career interests. Students also visit industrial facilities and assist engineering faculty with their research. Extracurricular activities such as sports and parties are also scheduled. Academic, career, and personal counseling are available from both professional and peer counselors.

A unique aspect of the Carnegie-Mellon program is that students are allowed complete freedom to choose how they use time outside of class. Although extra study sessions and tutoring are made available, none of these sessions is mandatory. However, students are required to present evidence of how they used their time and students have typically chosen to attend the tutoring and study sessions. Interestingly, their academic performance was higher when given the freedom to choose.

CONCLUSION

This chapter discusses the activities and programs which should take place during the summer prior to the students' freshman year to ensure that the student is properly matriculated. Essential activities include housing, financial aid budgeting, diagnostic testing, advising, registration, and orientation. Depending on the background of the students, the expectation of the university, and the availability of resources, an MEP can tailor a matriculation program to meet the needs of each institution.

CHAPTER 5

A Model Orientation Course

by Raymond B. Landis and Kathy Hada

California State University, Northridge

INTRODUCTION

This chapter presents a model orientation course* for new freshmen participating in a minority engineering program (MEP). The necessity for the type of orientation course described here and the potential benefit to students cannot be overemphasized. In the view of the authors, it is a crucial component — if not the single most important element — of an effective MEP program. Through it, the MEP staff can have a major positive impact on the students during the most critical period of their development.

The impact of an orientation course derives from the need to guide minority engineering freshmen past obstacles that they typically encounter during their first year of college and to aid them in adjusting to what may be their first exposure to a predominantly white environment. The adjustment problems can be particularly severe for minority students when their number in an academic unit, such as a school of engineering, is small. The resulting ethnic isolation has a number of ramifications which can impinge in a negative way on the students' academic performance. These include the practical difficulty of finding other students for group study and information exchange as well as the psychological burden of feeling out of place and unwanted. Students in this situation are generally forced to separate their academic and social lives. When a student's friends are not pursuing a difficult academic major, negative peer influence is the likely result.

A freshman orientation course can mitigate if not completely reverse these factors. By meeting with MEP students regularly and frequently throughout their freshman year, MEP staff can exert a level of influence that is unlikely to be attained in any other way. A course provides a formal structure and sufficient incentive to ensure a high level of student participation. In a course format, students will view their orientation as an important, integral component of their freshman year, rather than as an optional or peripheral part.

GOALS AND OBJECTIVES

The orientation course should entail the same kinds of goals and objectives that any orientation experience would include to help the freshmen overcome the barriers they typically encounter at the university level. The course should be carefully planned and executed to make the students feel supported in their new environment, bolster their expectations and self-confidence, and develop the skills necessary for them to succeed. More specifically, it should allow them to get to know and interact with the other students, staff, and faculty in the program. It should enable them to explore and clarify their educational and occupational goals, and clearly understand the employment opportunities and demands in the engineering profession. Above all, it should cultivate feelings of warmth, friendliness, and caring.

The major premises of the orientation course described here are that (1) new students generally have unclear goals and values; (2) they are apprehensive and anxious about their unfamiliar surroundings and experiences; and (3) most need to improve their study skills. An ancillary premise is that the course can serve as an effective mechanism for interaction between the students and MEP, one which the MEP should take advantage of to open lines of communication, make the students feel at home, and monitor the students' progress.

Given these premises and general goals, the course has the following specific objectives:

1. To build the freshman class into a community of students who support each other academically, socially, and emotionally
2. To orient the students to the environment of the university
3. To sensitize the students to the cultural factors affecting them
4. To strengthen the students' communication, problem-solving, leadership, and study skills
5. To motivate the students through an increased awareness of the opportunities and rewards of careers in engineering or computer science
6. To monitor the students' academic progress and to gather data necessary to the operation of the MEP

* The course described in this chapter was developed over the past twelve years as part of the Minority Engineering Program at California State University, Northridge.

COURSE FORMAT

The orientation course described in the rest of this chapter was developed for a university operating on the semester system. A total of 4 units, the course is conducted as a 3-unit course in the fall semester and a 1-unit course in the spring. During the fall semester, the course meets for two one-hour sessions and one two-hour session each week. The two-hour session permits certain types of activities and exercises for which a 50-minute period is not adequate. The course is mandatory for all MEP freshmen, but does not provide credit in either general education or the engineering major. It does, however, carry credit towards graduation. Students in the course receive letter grades—based on their attendance, participation, and performance—for both the 3-unit segment in the fall and the 1-unit segment in the spring.

Because the course will typically enroll sixty to eighty students, it is large enough to support two or more instructors. This team-teaching approach is generally a good idea as it distributes the workload among several instructors, rather than just one, and it exposes the freshmen to more MEP staff and/or engineering faculty.

Faculty or administrative approval will be required if the course carries academic credit. Where possible, existing orientation, introduction to engineering, or problem-solving courses can be adapted and utilized. Gaining approval for a new course is likely to be a long and difficult process requiring a persuasive case and the development of political support. If approval for a credit course cannot be obtained, the orientation can be conducted on a non-credit basis with incentives such as acceptance into MEP, eligibility for scholarships, priority registration for the following term, etc. However, experience has shown that this approach tends to be less effective.

The remainder of this chapter discusses course methodology, the establishment of norms, the basis for grading, and achieving course objectives.

TEACHING METHODOLOGY

The instructors of the orientation course should view themselves less as "teachers" and more as "facilitators," helping the students to learn instead of force-feeding them facts, ideas, and opinions. Consequently, they should avoid giving lengthy lectures, which can be boring and unproductive, and employ teaching methods that require the students to actively participate in their learning. Role playing, group projects, workshops, peer evaluations, field trips, and guest speakers are the dominant kinds of teaching/learning activities that should be utilized in the course.

One particularly successful teaching method is a four-step process consisting of commitment, exploration, analysis, and action. The instructors can use it to cover topics that do not involve a large body of factual or technical information and that lend themselves to inductive study. Below is a brief description of the process.

Commitment

Before learning can take place, students must commit themselves to what they are studying. They must acknowledge that a subject is worthwhile or relevant for them to know before they will invest their time and energy to learning it. One way to secure their commitment is for the instructor to simply tell the students why a particular subject is important to know. A more effective way, however, is to let the students decide for themselves. This latter approach is what should be used. When introducing a new topic (study skills, for example), the instructor should first ask the students to think about its relevance and to cite reasons why it is important to learn how to study. Through class discussion and censensus, the students will define for themselves the importance of study skills, and so commit themselves to learning more about it.

Exploration

Once the students are committed to learning a subject, they need to explore it. To accomplish this, the instructors should conduct a brainstorming session to elicit answers to questions such as "What do I already know about X?," "What are the advantages/disadvantages of X?," and "How does X affect me?" As students offer answers to these kinds of questions, the instructors should write the responses on the chalkboard for the entire class to read and think about. All answers are acceptable. Neither the instructors nor the students may judge the responses until the exploration is completed.

Analysis

After the topic has been thoroughly explored, the next step is to analyze the responses. While the method of analysis will depend on the topic, the basic purpose of this step is to study the results of the brainstorming session. With help and guidance from the instructors, the students should determine the most important responses, prioritize or rank the others, and weed out the irrelevant or least important ones.

Action

Taking action can translate into a number of activities. If, for example, the outcome of the analysis is a decision which the students must make (i.e., "Should I major in electrical or chemical engineering?"), then the action takes the form of a decision. If the analysis demands a judgment (i.e., "A strong liberal arts background is an important part of my education"), then the action is judging. If the results of the analysis mean the students must do something (i.e., "I need to improve my notetaking skills"), then that is the action.

The attachment at the end of this chapter shows the 4-step process "in action," as it is applied to the topic of study skills. Other topics well suited to the process include "Why Major in Engineering?", "Futurethink," "What Employers Look for in Applicants," and motivational topics such as "What Does It Mean to Excel?" "School as Your No. 1 Priority," and the "The Analogy between Going to School and Jogging" (i.e., a comparision of two activities that are "painful" but also beneficial and rewarding).

NORMS

At the beginning of the orientation course, the instructors should set out behavioral norms that will apply to the class throughout the year. It is important for the freshmen to understand and agree to the norms so that the class can proceed optimally. As most of the norms are applicable to virtually all classroom situations, their benefits to the students will extend far beyond the year-long orientation course. Examples of appropriate norms are:

1. Responsibility — The students are expected to attend and participate in class, even if participation merely means paying attention and actively listening. They must realize, however, that their participation in the orientation course, in the MEP, and in the university, is voluntary. They are there because they choose to be.
2. Punctuality — As an adjunct to responsibility and as a courtesy to both their teachers and classmates, the students should be punctual in their work and attendance.
3. Identity — The students must realize that they are a special group of students in a special program. Their identity as MEP students and preprofessionals should result in the two related norms of cohesion and support. That is, the students should enhance their identity by sticking together and supporting one another.
4. Conflict — The students must realize that conflict and disagreement are acceptable, even with the instructors. They also need to know how to deal with conflict, how to resolve problems, and how to negotiate fairly and effectively.
5. Accessibility — Anyone can have time to speak in small groups or in plenary class gatherings, if he or she so desires. Also, the students must know that their instructors are approachable and willing to talk with them out of class. All professors are required to hold office hours, but it is up to the students to use this avenue of communication.

GRADING

Grades for the course are determined by (1) the students' attendance, (2) a notebook they are required to keep, and 3) their performance and participation in a self-selected group project.

Attendance

Attendance is a significant barometer of how the students are faring in school. Regular attendance generally coincides with acceptable or successful progress, while low or sporadic attendance quite often signals trouble. Accurate records of students' attendance, therefore, bothersome though they might be for a class of sixty to eighty students, are essential if the MEP wants to oversee each student's progress. Good attendance quickly becomes an incentive for the students. They know from the outset that one-third of their grade in the course will be based on their attendance, and they soon learn that they cannot perform well on their notebook or group project work without attending class.

Notebooks

The notebooks which students are required to keep should contain (1) detailed notes on anything presented in class, (2) a description of their contributions to the group project, and (3) a 500-word essay on "Why I Want To Be an Engineer or Computer Scientist" (fall assignment) and "My Experiences in MEP" (spring assignment). The notebooks serve a number of purposes. First, as notetaking is one of the best methods of learning, the students tend to learn more and better when they take notes or write about class activities. Writing forces them to concentrate and reflect on the subject at hand, and so helps them clarify their thoughts and feelings about it. Second, the notebooks provide the instructors feedback about the students' understanding of and commitment to their education, their future profession, and the MEP's role in both. Good, thorough notes reflect a solid grasp of the ideas and issues presented in the course. The students' description of their contributions to the group projects requires that they assess their performance and, in essence, "grade" themselves on their involvement. The end-of-semester essays demand that they focus on and clearly understand their professional goals and the support afforded them by the MEP.

The instructors need not collect and evaluate the notebooks until the end of each semester, but they should conduct periodic, informal spotchecks to make sure the students are doing their work. The instructors' assessment of the students' work in the three notebook components—the class notes, the description of their group project contributions, and the 500-word essays—constitutes one-third of the students' grades in the course.

Group Projects

The group projects are a major feature of the orientation course and take up a sizable chunk of class time during the fall semester. The students are divided into groups of approximately eight. Each group

is responsible for choosing, planning, implementing, and presenting a special project such as selling MEP T-shirts, producing a multi-media show about the MEP, or creating an artistic wall-hanging for the MEP office. The only guidelines are that the projects should impact the other MEP students in some meaningful way, and that the groups must be prepared to present their completed projects to the rest of the class by the end of the term. The instructors should act as facilitators to the groups, allowing each to pursue its project in a largely unstructured setting and helping the students to understand the group dynamics they invariably experience.

In choosing a project, dividing up the work, and presenting the completed product at the end of the term, the students come to appreciate the advantages and obstacles of group collaboration, they become well acquainted with the other students in their group and learn to value each other as resources, and they sharpen their leadership and decision-making skills. They discover the necessity of taking initiative, sharing responsibilities, and reaching a consensus, and learn how to deal effectively with any unreliable or non-participating member of their group.

A key component of the group projects is evaluation—by both the students and the instructors. The groups should be required to evaluate one another as they prepare their projects and when they present them at the semester's end. During the "in-progress" evaluations, the students learn to give and accept non-judgmental criticism and to apply their observations to their own situations. When they evaluate the presentations at the end of the semester, they should assess the impact of the project on MEP students and the quality of the actual presentation. The instructors should conduct similar evaluations of the group projects, but reserve their formal evaluations for the presentations. Their evaluations also should be based on the project's impact on the MEP plus the presentation itself, but their evaluation of a project should carry more weight than the peer evaluations. Together, the instructors' and students' evaluations will yield the final third of a student's grade in the orientation course.

ACHIEVING COURSE OBJECTIVES

The notebooks and group projects are two major criteria for determining a student's grade in the orientation course. But they also contribute to several of the course objectives. While it is probably true that the notebooks and group projects address **all** the course objectives in varying degrees, they contribute most directly to building the freshman class into a community of students and to strengthening the students' communication, problem-solving, and leadership skills.

Other lectures, activities, and assignments can be included in the course to meet the remaining objectives. Following are brief descriptions of such activities, according to the objective they satisfy.

Community Building

Undoubtedly, the greatest benefits of the orientation course to MEP students is the close association it provides with other students from similar backgrounds who have similar objectives. The MEP freshman class becomes the central support group both academically and socially for each student in it. The class provides a base of operation from which the student can operate successfully in dealing with all facets of the university experience.

One key to building a strong group is to get the students to know each other. Another is to get the students to realize that working together they will be more effective than working alone. To facilitate the students getting to know each other, the instructors can conduct name-memory games, small group exercises, and other interactive activities. The process will be aided if the students are clustered to the extent possible in their other classes.

It is important that students have an appreciation for the value of the freshman group. In junior high and high school, the MEP student may not have found others to link up with for academic purposes and hence may have developed a self-reliant and independent approach to school, tending to work and study alone. The students must be persuaded that these behaviors are likely to result in poor performance at the university. Every effort should be made to teach the students the benefits of networking—that people are generally more effective in groups than individually. A cooperative spirit in which MEP students support and encourage each other should be fostered. Sharing of information and group study should be encouraged. It should be emphasized that learning to work effectively with other people is good training for the work world.

Orientation to the University

The first way to acclimate students to their new environment is through introductions: to university policies and procedures, to campus services and agencies, to university personnel (faculty, administrators, counselors, the MEP staff), and as discussed above, most importantly to each other. While many introductions take place during the students' matriculation phase (i.e., after they commit to attending the university but before classes actually begin), the orientation class is a natural forum for completing or reinforcing numerous necessary introductions.

Many MEP freshmen will take advantage of their university's summer orientation program, at which they learn about the university and often are able to register for their courses for the fall semester. They may also attend special MEP summer programs, interfaced with the university-wide orientation program. Still, by the time classes begin, students may have forgotten or be unclear about various university regulations and campus services. Hearing about them once at an orienta-

tion session is often not sufficient, especially when they are bits and pieces of an extensive battery of facts, rules, recommendations, and instructions.

Therefore, one of the first orders of business in the MEP orientation course is to make sure the students understand relevant policies and regulations, know where campus services are located (the learning resource center, student health center, student union, libraries, etc.), and get to know their MEP "family." Much of the general information dissemination can be accomplished by lectures, question-answer sessions, guest speakers, and campus tours. The MEP staff can be invited to class meetings, as well as the engineering school dean, associate dean, and other key administrators.

Cultural Awareness

The focus of this objective is twofold: to sharpen the students' understanding of their ethnicity and minority status, and to enable them to interface effectively with the majority culture of the university. Through informal "rap" sessions, group exercises, and lectures, the instructors should help the students reflect upon the historical reasons for their minority status, particularly in view of the fact that they live in a society that uses "white" as the standard for comparison. They should consider the nature and manifestations of racism, and be able to translate their insights into practical methods for coping and succeeding in the dominant cultural mainstream.

The students also must understand, that regardless of the direction of their plans for the future, they will all become part of a unique group buffering the differences between the minority and majority cultures. Rick Ainsworth of California State University, Northridge, suggests the metaphor "*compradore*" to describe the situation in which MEP students' education and profession will place them: the aggregates of two cultures—their own ethnic culture and the dominant culture—similar to the classic *compradores* who remained in their colonized countries but were educated by and worked for European entities. As minorities and professionals in a field that has been traditionally underrepresented by Blacks and Hispanics, and in a society that is only superficially integrated, the MEP students will constitute their own *compradore* class. Whether they associate primarily with their minority culture or the majority culture, they will be unique members of both—amphibious in their language, behavior, and outlook.

Study Skills

In the section above on "Methodology," the description of the 4-step process concludes with a list of topics that are covered through the process, and at the end of the chapter there is an example of the process applied to study skills. The study skills example is the first in a series of class activities that address the objective "to strengthen the students' study skills." After working through the process to identify the kinds of skills the students need to develop, the instructors should use the process to study each skill individually. Students generally need help in time management, self-discipline, note taking, test preparation, and test-taking strategies, and approximately 1-2 hours of class time should be allowed to study each topic. If, after the class exercises, students need more help or want to spend more time developing their skills, they should be referred to campus agencies such as the learning resource center or other tutorial centers where they can work at their own pace through independent learning materials or enroll in special study skills workshops.

Motivation and Career Awareness

A number of topics that can be covered through the 4-step process address the affective objective, "to develop the students' motivation to achieve their engineering or computer science degree and to succeed in the engineering profession." These topics include "Why Major in Engineering?", "Futurethink," "What Does It Mean to Excel?", The Analogy Between Going to School and Jogging," and "School as Your No. 1 Priority." Other activities can be included as well to achieve the motivational objective; in fact, the 1-unit segment of the orientation course in the spring semester focuses exclusively on the engineering profession. The overall study of the profession, however, should encompass the entire academic year. Through special lectures, guest speakers, and field trips, the students will learn about the different areas of engineering and begin to define their own futures as engineers or computer scientists.

To discuss the various areas of engineering, the school dean and department chairs might be invited as guest speakers. They can talk to the students about the areas of specialization available to them at the university, the kinds of work they could pursue with their baccalaureate degrees, and the opportunities for advanced study. Practicing engineers can be invited to explain what they do in their varied capacities. Representing the different engineering/computer science options, these guest speakers could discuss their duties and responsibilities, salaries, and career development opportunities. Lastly, guest practicing engineers and engineering managers can be invited to talk about related areas of work, such as sales, service, management, development, test, design, and research.

To expand upon the information presented by guest speakers and to build the students' incentive to achieve their educational and occupational goals, "role model" engineers should also be invited to address the class. Minority engineers, especially MEP graduates now in the profession, should regularly visit the class to talk about what they do and how their work has affected

their lives personally, professionally, socially, and economically.

Field trips to local industries can likewise enhance the students' exposure to and understanding of the engineering profession. To make the experiences as meaningful and educational as possible, the instructors should work closely with industry personnel in establishing the itinerary of each field trip. They should steer away from traditional "show-and-tell" tours, and try to get the students actively involved through on-site programs and activities.

Monitoring Student Progress

The MEP can use the freshman orientation class to monitor student progress in two ways. First, as the students' attendance is a key indicator of how they are faring in school, the instructors should maintain accurate records of attendance and review them periodically during the course of each semester. Students whose attendance is low or sporadic should be called in for special conferences and counseling sessions in an attempt to identify and correct problems that may be interfering with their schooling. Since the students know from the outset that attendance constitutes one-third of their grade in the course, good attendance is generally an incentive for them. In light of this, and given the emphasis placed on the MEP students' special identity and community-building efforts, the MEP should interpret poor attendance as a warning signal and act quickly to intervene.

The MEP can also use the orientation course as a communication conduit for mid-semester evaluations. Students whose grades are slipping or who are in trouble academically can be reached via the orientation class for counseling and, if warranted, special tutoring sessions can then be arranged. Students who are progressing satisfactorily should also be contacted through the orientation class to commend and reinforce their performance.

Student Feedback & Course Evaluation

The second part of Objective No. 6, "to gather data necessary to the operation of the MEP," refers mainly to the students' response to the orientation course. The MEP will want to know how effective and meaningful the course is to the students, what its strengths and weaknesses are, and how the students feel it could be improved.

To obtain as accurate and honest an assessment as possible, the MEP should allow a period of time to lapse after the course ends before they ask the students to evaluate it. A retrospective judgment is generally more reliable because the students have had time to reflect upon the course and see the fruits of their experiences in it. It is not uncommon for students to have an appreciation "lag," not fully recognizing the value of the course for as long as several years. Some grow weary or their enthusiasm wanes as the year-long course progresses, especially when the pressures of their other courses bear down on them. But later, after the course has ended and they evaluate it in retrospect, they can be more objective about their reactions. The experience of these authors has been that most students rate the course highly in their retrospective evaluations, and years later, when they are nearing graduation and look back at their MEP experiences, they frequently cite the orientation course as the component of MEP which was the most beneficial to them.

APPENDIX

STUDY SKILLS PRESENTED THROUGH THE 4-STEP METHOD OF COMMITMENT, EXPLORATION, ANALYSIS, AND ACTION

1. **Commitment**
   In order to commit the students to the "study" of study skills, the instructor begins by asking general questions such as, "Why do you think it is important to have good study skills?" To help the students in this first step, he might present the following analogy between "studying" study skills and learning the game of chess: "If, for example, you wanted to learn how to play chess, you would, of course, learn the rules and practice. But to learn to play the game well, you would do other things as well. You might observe how other people play, especially chess 'masters,' and you would study the game itself—not only the various moves, but the most effective, strategic kinds. The same is true about studying. To know how to study well, you must do more than merely 'practice'; you need to study the skills involved and learn from others who study well."

2. **Exploration**
   Once the students are committed to the idea of "studying" study skills, it is time to explore the subject by considering a question such as, "What important skills do you need to succeed in college?" As students name various skills (preparing for tests, managing one's time, taking notes, and so forth), the instructor writes them on the board for the class to note. He then compiles a list of the cited skills in preparation for the next step.

3. **Analysis**
   After the students complete the exploration step and the instructor has a list of the skills mentioned, he creates a "Study Skills Survey" (attached) in which the students evaluate each skill according to its importance ("How important is this skill to me?") and their proficiency ("How proficient am I in this skill?").

4. **Action**
   The completed "Study Skills Survey" will dictate the appropriate action. Those skills which the students rank high in importance and low in proficiency are the ones they need to develop. The action, then, is to strengthen one or more study skills that the student has identified as important to know.

MEP FRESHMAN CLASS STUDY SKILLS SURVEY

BELOW PLEASE INDICATE TWO THINGS:

- Under IMPORTANCE, circle the number that best describes how important you feel each item is if a person is to be successful in their studies.
- Under EFFECTIVENESS, circle the number *that best describes how you rate yourself in effectiveness in each of the categories.*

1. BUDGETING YOUR TIME

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

2. SELF-DISCIPLINE

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

3. POSITIVE ATTITUDE

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

4. DEVELOPING STUDY SKILLS

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

5. TAKING NOTES

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

6. USING LIBRARY

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

7. HOW TO CONCENTRATE

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

8. HOW TO USE INSTRUCTOR EFFECTIVELY

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

9. HOW TO PREPARE FOR TESTS

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

10. TEST-TAKING STRATEGIES

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

11. HOW TO USE UPPERCLASSMATES EFFECTIVELY

Importance							**Effectiveness**						
Not Very						Very	Poor						Excellent
1	2	3	4	5	6	7	1	2	3	4	5	6	7

CHAPTER 6

Strategies for Monitoring Student Progress and Maintaining Retention Data

by Benson E. Penick

Benson Penick and Associates

INTRODUCTION

Monitoring student academic performance and progress is essential to improving the number and quality of minority engineering graduates. Although monitoring requires the collection, maintenance, and evaluation of substantial data, it offers several important benefits. Assessing a beginning student's academic records, in conjunction with testing, can identify potential problems early, when they can best be remediated. On a continuing basis, data on student performance and retention are necessary to develop and refine effective intervention strategies. Furthermore, this type of data can also be useful in conveying the program's effectiveness to supporters.

This chapter discusses approaches to (1) assessing the entering students' academic and personal needs through an entry questionnaire; (2) monitoring students' academic performance during a specific term in order to intervene in time to make a difference; (3) tracking students' overall progress term by term in relation to a long range plan for their graduation; and (4) examining aggregate data to gain insight into the program's effectiveness in improving student retention and graduation.

Specific examples used to illustrate the monitoring approach are based on the author's research into factors likely to influence the success of minority engineering students.[1] Although some of the recommended strategies can be implemented in any situation, others rely on the existence of certain program elements. In any case, an overall monitoring approach must be tailored to the unique conditions that prevail in each given setting.

PLANNING THE MONITORING APPROACH

A comprehensive monitoring effort requires thorough planning and close coordination with various campus offices and personnel. Planning should include a clear definition of the problem, a statement of the specific goals and objectives of monitoring, and delineation of the usefulness to be gained from gathering such data.

Coordination with Other Campus Offices and Personnel

Monitoring student academic performance requires information from a number of campus offices and personnel. These include, for example, the admissions office, which can provide high school transcripts and SAT scores for entering students; the testing office, which can provide scores on required math, science, and English placement tests and can administer other tests as needed; and the registrar's office, which can provide official enrollment records, final term grades, and graduation lists. Faculty can be solicited to obtain intermediate academic results or requested to notify the MEP staff when one of their student's performance is below par. Other MEP students and tutors can also be helpful in identifying problems.

Because the monitoring program relies on the cooperation of other campus offices and personnel, they should be involved in the planning process. They can provide valuable insights concerning what should be monitored, what problems might be encountered in the process, and which strategies seem likely to resolve the problems. By articulating the need for and value of a monitoring program and by seeking widespread collaboration, MEP directors should be able to generate considerable support for the monitoring effort.

Defining the Problem

The first step in the planning process should be a clear and explicit statement of the problem. This should take account of the past academic performance of ethnic students at the institution. Deficient performance in the past should be assessed in relation to specific aspects of the educational process so as to develop intervention strategies that can be systematically observed. It is not enough to know that only a small percentage of minority students who start engineering graduate. The problem should be defined as specifically and in as much detail as possible. Examples of specific problems that, once identified, lend themselves to systematic monitoring are:

[1] Penick, Benson E. and Morning, Carole. "Retention for Minority Engineering Students. "Report on the 1981-82 NACME Retention Research Program. National Action Council for Minorities in Engineering. New York, N.Y., February, 1983.

- Freshmen MEP students are not passing calculus because the pre-calculus course is not preparing them adequately;
- In an attempt to keep students on a four-year track, faculty advisors are requiring students to take a heavier load than they can handle;
- MEP students who are ethnically isolated in their classes are performing below potential;
- Because of poor registration priority, MEP sophomores are not getting into the recommended sections but instead are placed in night classes which tend to be taught by part-time instructors.

By describing problems such as these in depth, the MEP can develop and test strategies for improving retention and graduation rates and can better focus its monitoring activities.

Specifying Objectives

Once the problem is clearly defined, the objectives of a monitoring program can be set out more precisely. The following are some key problems associated with the failure of minority students to graduate and objectives monitoring can achieve:

Problem	Monitoring Objectives
Entering students have unrealistically high assessments of their academic strength	To identify students whose profiles suggest that they are likely to be overly confident
Students fail to recognize the extent to which they comprehend course content/ concepts	To obtain early feedback on students' performance
Students fail to utilize available support services	To measure the number, duration, and pattern of contacts between students and those who provide services
Inadequate intervention on the part of the program	To measure the incremental impact of service components on different types of students

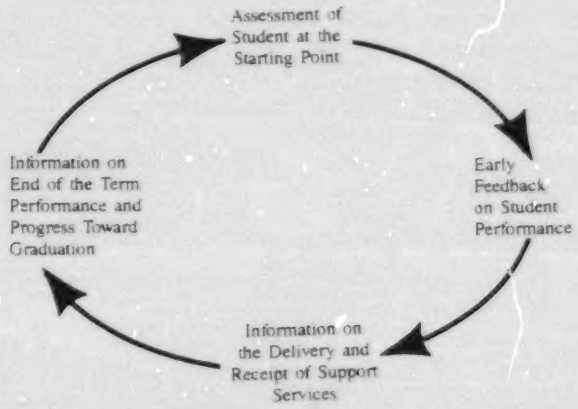
Making Use of Monitoring Data

A key part of the overall monitoring plan should be a clear delineation of how the data and information obtained will be applied. That is, beyond accumulating statistics and analyzing them, what actions can the MEP initiate to halt or reverse negative findings? For example, what can be done about students who are identified as having unrealistically high assessments of their academic strength? What can be done for a student who is failing calculus and chemistry at the midterm point? What can be done for a student whose academic performance is poor but who is unwilling to take advantage of available program support services?

Data obtained from a monitoring program can be useful in numerous other ways. They can provide documentary justification for establishing or maintaining alternate admission criteria for ethnic students. It can persuade institutional and corporate supporters that the program is effective. They can furnish the basis for research and publications which promote program visibility. And they can be used to assess the performance of MEP staff.

IMPLEMENTING THE MONITORING PROGRAM

Once planning is complete, implementation is next. In the implementation of a monitoring effort each successive step is dictated largely by the knowledge gained in previous stages. For this reason, monitoring should from the beginning be designed to increase the MEP director's understanding of what needs to be done to produce more and better qualified minority engineering graduates. Since successful completion of the first year is a critical step, initial monitoring strategies should focus on first-year students. With slight modification these strategies can also serve students who are further along. A proposed monitoring model is shown below:


Assessment of Student at the Starting Point
Early Feedback on Student Performance
Information on the Delivery and Receipt of Support Services
Information on End of the Term Performance and Progress Toward Graduation

Assessing the Student at the Starting Point

The first step in an effective monitoring program is to conduct an initial assessment of the student. This assessment should aim at determining not only the student's past academic background but important personal and interpersonal factors, values, and attitudes that relate to the potential for academic success.

One way to make this assessment is by means of a questionnaire. A questionnaire[2] designed for this purpose is presented in the Appendix to this chapter. This

[2] This questionnaire, designed by Antonio Garcia, MEP Director at California Polytechnic State University, San Luis Obispo, incorporates input from the author and from other California MEP Directors.

questionnaire seeks information on the student's academic background and skills, technical background, ability to reason logically, personal traits, interpersonal skills, and understanding of engineering as a major and as a career. It is in a form which can be adapted and modified to conform to local differences.

Completion of the form will begin to give the student a clearer understanding of what is required to be a successful engineering student and where he or she is deficient. The assessment process will be most beneficial if students can meet with a counselor to discuss their responses. In this way potential problem students, such as those whose academic self-concept is inconsistent with their past performance, can be identified and targeted for special intervention activities such as close monitoring, weekly counseling, or mandatory tutoring.

Early Feedback on Student Performance

Feedback on a student's academic performance is of critical importance to a successful monitoring effort. It is particularly important that feedback begin as early in the academic term as possible so that there will be time for intervention as soon as the need for it is indicated. Detection of problems at midterm may be too late. Although the performance of all students should be monitored, it is crucial for first-year students. Students who get off to a good start by developing good study habits and establishing a strong background in the fundamental math/science courses are likely to succeed.

Attendance problems are often a warning signal. MEP professional and student staff should require attendance at all program functions such as orientations and tutoring sessions. Follow-up phone calls, visits, and written materials to individuals who seem to be avoiding functions can make a difference. MEP staff can monitor classroom attendance through instructor feedback. Random staff visits to classes or inquiries to other students in a class are also advisable. Other techniques for monitoring students' academic progress are discussed below.

Feedback from Faculty—Faculty are in the best position to provide feedback on students' academic performance. Since providing this feedback usually requires extra work on the part of the faculty, it is important that the MEP director create good relations between the program and the faculty. (Strategies for developing faculty involvement in and support for MEPs are discussed in Chapter 14.)

There are several ways to solicit feedback from faculty on students' performance. One direct way is to send them a form of the type shown in the Appendix to this chapter.

As demonstrated by the sample form, any instrument for this purpose should be clear, brief, and easy to complete. To avoid burdening the faculty, a form of this type can probably only be requested once a term. If this is done at the midterm point or after, it will be too late for effective intervention. If sent too early, meaningful information on the students' performance may not be available. Exactly when is the right time is admittedly difficult to determine; however, it is worth attempting to get feedback early and convincing the faculty of its value. Often when faculty realize that the MEP staff are interested in knowing about any deficient performance by MEP students and will do something about it, they will begin to take initiative by calling or coming by the MEP office to provide input on students.

Where MEP students are heavily clustered in common sections of their classes, arrangements for continuous monitoring can be made with the faculty teaching those sections. For example, if all MEP freshmen are clustered in several math classes, the teachers may agree to send their grade sheet to the MEP director after each test. This approach can provide timely input on student performance throughout the term.

Tutors/Advisors/Workshop Leaders—All of those working with MEP students-tutors, faculty advisors, and math/science workshop leaders—can play a key role in the overall monitoring strategy. As part of their training they should be encouraged to continually monitor students' homework, quizzes, and tests, and to notify MEP staff when they detect unsatisfactory performance.

Parental Involvement—It is desirable to keep parents informed of a student's performance, particularly when it is substandard. However, because of interpretations of the privacy act at many institutions, it may be inappropriate for the MEP staff to convey that information directly. Parents need to be told how they can keep informed abut their child's performance and progress.

Some MEPs hold weekend parent conferences in those cities from which large numbers of students are drawn. These conferences describe the institutional environment, the range and sources of services available to students, and the results that previous minority engineering students have achieved. A critical part of this presentation is to point out that the pace, the amount of work required of students, and the competition from other students are such that students need both peer and program help.

Parents should be told to check periodically with the MEP director or staff person if they are not certain that their son or daughter is actively involved in the program. Because this is so important, it should be stressed. Parents can also be encouraged to request and refer to course syllabi and keep track of test dates. They should be aware that the MEP staff can assist them in interpreting unclear results. Furthermore, parents should be encouraged to confer with their daughters

or sons on a regular basis about their academic performance.

Controlling Drops/Adds/Withdrawals—In order to avoid situations wherein students jeopardize their financial aid, good academic standing, and/or prospects of satisfactorily completing a given course, the MEP needs a mechanism to alert its staff prior to a student's dropping or adding a course once the period for no-consequence drop/adds has passed. It may be possible to set up a procedure which requires an MEP staff member's signature as part of the authorization process. Since the dean of engineering's office often must authorize drop/add requests, its assistance should be sought. A code designating an MEP student could be used to indicate the need for referring that student to the program.

Buddy System—This system, also known as big brothers/sisters, is often used as a monitoring mechanism. A freshman student is paired with an upperclassman who helps acquaint the former with the engineering environment, provides or suggests support services, and monitors the freshman's progress. This system tends to work particularly well on residential campuses, where the sense of student community is well developed. On commuter campuses, the pairings probably should be computerized to ensure compatible course schedules.

Computer Assisted Instruction—CAI is a vehicle by which to measure a student's progress in a particular course. The computer will display a record of completed objectives. Students whose backgrounds have not developed their discipline to the extent required for engineering study could be enrolled in specially adapted CAI courses that establish concrete objectives to be completed according to a term-long schedule.

Feedback on Student Support Services

Support services exist to facilitate students' academic progress and success. Thus, it is important for the MEP director to know (1) the extent to which services are available; (2) the extent to which students use the services; (3) their reasons for using the services; and (4) the outcomes resulting from their use of the services. Simple forms can be designed to document student interactions with tutors, counselors, advisors, and any others who provide support services.

Although lack of participation in activities that offer academic support may indicate that a student is insufficiently motivated, it may also indicate dissatisfaction with the quality of the services provided. Thus, it is important to provide a mechanism to elicit student feedback. Students should be asked to indicate their awareness of all available services and their perceptions of the usefulness and effectiveness of each service.

MAINTAINING RETENTION AND GRADUATION DATA

The ultimate measure of the effectiveness of an MEP program is its success in retaining and graduating students. It is therefore very important that an MEP program at least maintain "bottom-line" retention data.

Forms for gathering such data are presented in Figures 1 and 2. They are used by a network of fifteen California MEPs funded by the MESA (Mathematics, Engineering, Science Achievement) organization. The first form is completed when a student initially enrolls in an MEP. It includes some basic information on the student's background and past academic performance. The second form is used to record the student's continuing progress: it is completed at the beginning of each year for all students who were enrolled during the previous year, including those who dropped out. These forms can generate information to compile retention data, the percentage of students on probation, the number of students who had summer jobs, and average GPAs.

Figure 3 is one way a program's overall retention and graduation data can be presented. This table shows the number of students in each cohort group and the number and percentage persisting one, two, three, or more years after entering. Also shown is the number graduated. This type of chart is best restricted to those who entered as freshmen. For transfer students who enter with varying amounts of prior coursework, retention data cannot be presented in this simple manner.

CONCLUSION

This chapter presents strategies for monitoring student academic performance and progress. An overall monitoring approach consists of assessing the student at the starting point, gaining early feedback on student performance, monitoring the delivery and receipt of support services, and gaining information on overall academic performance and progress toward graduation. An effective monitoring program aids in identifying students with problems, provides information for refining the intervention program, and provides data to demonstrate the program's effectiveness and success.

FIGURE 1

MEP Minority Engineering Program

ENROLLMENT FORM (EF)

Center ID ☐☐ – Student ID ☐☐☐☐☐

Instructions: The following questionnaire should primarily be completed by the student. The Program Director must sign the form, indicating verification of the information.*

Date _____

Social Security Number ☐☐☐ – ☐☐ – ☐☐☐☐

Last Name _____ First Name _____ MI ☐

Permanent Address

Number ☐☐☐☐☐ Street _____

City _____ State ☐☐ Zip ☐☐☐☐☐

Address while in School (leave blank if same as permanent address)

Number ☐☐☐☐☐ Street _____

City _____ State ☐☐ Zip ☐☐☐☐☐

Permanent Phone Number ( ) _____ Phone Number while in School ( ) _____

1. Date of Birth:
month ☐☐ day ☐☐ year ☐☐

2. Sex:
☐ 1. Male
2. Female

3. Ethnicity:
☐
1. American Indian
2. Black
3. Chicano or Mexican American
4. Puerto Rican
5. Other Hispanic
6. Other (specify)

4. Citizenship:
☐
1. U.S. Citizen
2. Permanent Resident Alien
3. Foreign Student Visa

5. Major:
☐
1. Computer Science
2. Engineering (Specify Area)
3. Other (Specify)

_____

6. Units Completed Toward Degree:
☐☐☐
☐ 1. Semester
2. Quarter

7. Years in College (Indicate number of years):
☐

8. Progress Toward Graduation:
☐
1. Have not begun Calculus
2. Currently taking first year Calculus
3. Currently in second year Calculus
4. Completed required Calculus, Chemistry, Physics, and currently taking Junior level courses
5. Currently taking Senior level courses

9. High School:
name _____
city/state _____

10. Year of High School Graduation:
☐☐

11. Participation in MESA:
☐ 1. Yes
2. No
☐ Years in MESA

12. High School GPA:
☐.☐☐

13. SAT Scores:
verbal ☐☐☐ math ☐☐☐

14. Years of High School English:
☐

15. Highest Education Level Achieved by Parents: (Indicate by placing the correct number in the proper square)
father ☐ mother ☐
1. Eighth grade or less
2. Some high school
3. High school graduate
4. Some college or university
5. Community college degree
6. B.S. or B.A. degree
7. Some graduate work
8. Graduate degree
9. Not sure

16. High School Math/Science Courses Completed: (Indicate 1 yes, 2 no)

☐	Algebra I	☐	Pre-Calculus
☐	Geometry	☐	Calculus
☐	Algebra II	☐	Chemistry
☐	Trigonometry	☐	Physics

I hereby apply for admission to the Minority Engineering Program and authorize the University to release my records to the Statewide MESA/MEP office. I understand that this data will be treated confidentially.

Student's Signature _____

*Director's Signature _____

FIGURE 2

MEP Minority Engineering Program

PROGRESS RECORD FORM (PRF)

Center ID ☐☐ – Student ID ☐☐☐☐☐

Instructions: This form should be completed in the fall for every student who participated in MEP during the past academic year; this includes the summer session.

Social Security Number ☐☐☐ – ☐☐ – ☐☐☐☐

Last Name ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ First Name ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ MI ☐

Permanent Address

Number ☐☐☐☐☐ Street ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

City ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ State ☐☐ Zip ☐☐☐☐☐

Address while in School (leave blank if same as permanent address)

Number ☐☐☐☐☐ Street ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

City ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ State ☐☐ Zip ☐☐☐☐☐

Permanent Phone Number ( ) _____ Phone Number while in School ( ) _____

1. **Past Academic Year: (e.g. 81/82)** ☐☐/☐☐

2. **Units Earned in Past Academic Year:** units ☐☐☐

3. **Units Completed Toward Degree:** ☐☐☐ ☐ 1. Semester 2. Quarter

4. **GPA:** Past Academic Year ☐.☐☐ Cumulative ☐.☐☐

5. **Academic Standing at End of Past Academic Year:**
☐ 1. Dean's List
2. Good
3. Probation
4. Disqualified

6. **Current Major:**
☐ 1. Computer Science
2. Engineering (Specify Area)
3. Other (Specify)
_____

7. **Years in College (Indicate number of years):** ☐

8. **Progress Toward Graduation:**
☐ 1. Have not begun Calculus
2. Currently taking first year Calculus
3. Currently in second year Calculus
4. Completed required Calculus, Chemistry, Physics, and currently taking Junior level courses
5. Currently taking Senior level courses

9. **Scholarships Received During Past Academic Year: (specify source(s) and amount(s))**

source	amount

10. **Expected Year of Graduation (B.S.):** ☐☐

11. **Summer Job: (Did student have an engineering/computer science related job during the past summer?)**
☐ 1. Yes
2. No
company _____
city/state _____

12. **Status for Current Academic Year:**
☐ 1. Continuing as full-time student (12 units or more)
2. Continuing as part-time student (fewer than 12 units)
3. Graduated
4. No longer enrolled (specify reason)
_____

Director's Signature _____

Date Form is Completed _____

COMMENTS _____

FIGURE 3

MINORITY ENGINEERING PROGRAM (MEP)
CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

Total Entered = 818
Total Graduated = 114
Total Persisting = 396

ACADEMIC YEAR ENTERED	NUMBER ENTERED	NUMBER OF STUDENTS RETAINED WITH YEARS SINCE ENTRY									NUMBER GRADUATED	NUMBER GRADUATED OR PERSISTING
		1	2	3	4	5	6	7	8	9		
1973-1974	23	19 (83%)	17 (74%)	15 (65%)	10 (43%)	7 (30%)	6 (26%)	3 (13%)	2 (9%)	0	4 (17%)	4 (17%)
1974-1975	40	28 (70%)	15 (38%)	12 (30%)	9 (23%)	5 (13%)	2 (5%)	1 (3%)	1 (3%)	0	8 (20%)	8 (20%)
1975-1976	60	51 (85%)	31 (52%)	21 (35%)	15 (25%)	9 (15%)	7 (12%)	5 (8%)	3 (5%)	3 (5%)	10 (17%)	13 (22%)
1976-1977	80	61 (76%)	40 (50%)	32 (40%)	25 (31%)	14 (18%)	9 (11%)	9 (11%)	2 (3%)		26 (33%)	28 (35%)
1977-1978	85	63 (74%)	52 (61%)	44 (52%)	32 (38%)	31 (36%)	27 (32%)	15 (18%)			30 (35%)	45 (53%)
1978-1979	88	76 (86%)	63 (72%)	59 (67%)	52 (59%)	48 (55%)	27 (31%)				24 (27%)	51 (58%)
1979-1980	96	84 (88%)	78 (81%)	54 (56%)	51 (53%)	47 (49%)					4 (4%)	51 (53%)
1980-1981	103	90 (87%)	75 (73%)	64 (62%)	64 (62%)						7 (7%)	71 (69%)
1981-1982	94	84 (89%)	71 (76%)	71 (76%)							1 (1%)	72 (77%)
1982-1983	105	93 (89%)	93 (89%)								0	93 (89%)
Fall 1983	74	74 (100%)									0	74 (100%)

APPENDIX

Student Evaluation Form

Student Name/Number:

Course/Section:

Instructor:

Date Sent:

Please assess this student in terms of:

	Very Good	Good	Fair	Poor	Very Poor	Can't Determine
	1	2	3	4	5	6
1. Attendance						
2. Timely submission of assignments						
3. Quality of homework assignments						
4. Quiz performance						
5. Test performance						

If you were to assign a grade at this point in the term, would it be (circle one):

A B C D E F

Is this student's performance (circle one)?

1. Improving
2. Stable
3. Worsening

Comments:

ENTRY QUESTIONNAIRE AND STUDENT STATUS REPORT

FOR M.E.P. FRESHMAN

ACADEMIC AREA

1. Circle the solid math/science background courses you have complete in high school with a "B" or better.

   Algebra I Geometry Chemistry

   Algebra II Calculus Physics

   Trigonometry

2. I have submitted projects to science fairs and/or similar events a total of # 1 2 3 4 times

3. I participated in a pre-college engineering program list MESA, PRIME or other Yes _____ (please name) No

4. In my last two years of high school, I studied (did homework) a daily average of
   1 Less than 1 hour
   2 1-2 hours
   3 2-3 hours
   4 3-4 hours
   5 More than 4 hours

5. I am able to concentrate on study for long periods. (2 to 3 hours at a time)
   1 Never
   2 Occasionally
   3 Half the time
   4 Almost always
   5 Always

6. I rate my ability to learn in lecture classes as follows:
   1 Poor
   2 Fair
   3 Average
   4 Good
   5 Excellent

7. I rate my listening skills as follows: Very weak 1 2 3 4 5 Excellent

8. I rate my notetaking skills as follows: Very weak 1 2 3 4 5 Excellent

9. I review my notes (material) before each class.
   1 Never
   2 Sometimes
   3 Half the time
   4 Almost always
   5 Always

10. I read ahead in my text to prepare for my next class.
    1 Never
    2 Sometimes
    3 Half the time
    4 Almost always
    5 Always

11. I carefully and quickly take notes in class so as to capture all of the lecture in my notes.
    1 Never
    2 Sometimes
    3 Half the time
    4 Almost always
    5 Always

12. I listen carefully and try to understand the "gist" of what the lecturer is saying then write down only these key point as my class notes.
    1 Never
    2 Sometimes
    3 Half the time
    4 Almost always
    5 Always

ACADEMIC AREA

13. My score on the SAT math portion was:
1 Under 424
2 425 to 490
3 491 to 540
4 541 to 600
5 601+

14. My score on the SAT verbal portion was:
1 Under 424
2 425 to 450
3 451 to 500
4 501 to 550
5 551+

15. How many hours a day do you think you will have to study in order to succeed in your college courses (do not include class time)?
1 2 or less hours
2 4 or less hours
3 6 or less hours
4 8 or less hours
5 10 or less hours

16. How much encouragement (to study engineering or computer science) did or do you get from the following?

	None	Little	Some	Much	Very Much
Parents	1	2	3	4	5
High School Teachers	1	2	3	4	5
College Recruiters	1	2	3	4	5
Friend(s)	1	2	3	4	5
Counselors	1	2	3	4	5
Other (specify)_____	1	2	3	4	5

17. I realize that engineer/computer scientist employers, when looking for prospective new employees, tend to consider students/graduates with the highest GPA's and best related work experience.
1 No
2 Yes

TECHNICAL & LOGICAL REASONING AREA

	Lowest ranking				Highest ranking
1. I rate my interest in studying math, science and technical courses almost exclusively for the next 4-5 years as follows.	1	2	3	4	5
2. I rate my ability and satisfaction envisioning, designing, and working on a project from the beginning of it through to its completion as follows:	1	2	3	4	5
3. I have worked in a job that was related to my chosen major/career.	No				Yes
	Lowest ranking				Highest ranking
4. I rate my enjoyment of discussions and conversations about technical area(s) in engineering and/or computer science as follows:	1	2	3	4	5

INTERPERSONAL AREA

	Lowest ranking				Highest ranking
1. I am able to work effectively with others as part of a team.	1	2	3	4	5
2. I have studied effectively with others in completing homework assignments and preparing for tests.	1	2	3	4	5

INTERPERSONAL AREA

		Lowest ranking				Highest ranking
3.	I expect to be able to meet and discuss concerns and interests with college professors/instructors and do so with confidence and ease.	1	2	3	4	5
4.	I am able to communicate orally effectively.	1	2	3	4	5
5.	I am able to communicate in writing effectively.	1	2	3	4	5

6. Based on your past experiences and what you know about the engineering major, what is your study preference (1=least preferred) likely to be in each of the following situations.

Study Alone	1	2	3	4	5
Study with MESA or PRIME grads	1	2	3	4	5
Study with a partner of my ethnic background	1	2	3	4	5
Study with a partner of any ethnic background	1	2	3	4	5
Other study partner (specify)_____	1	2	3	4	5

7. I am free from family and other obligations/ responsibilities and can plan to devote myself to my college studies without any distractions from these sources. Yes No

PERSONAL TRAITS AREA

1. What aspects of engineering most appealed to you (at the time you decided to study it)? Please circle the top 3.

1 Salary
2 Prestige
3 Challenge
4 Problem solving
5 Service to others
6 Contribution to Society
7 Type of work & work environment
8 Background it provides for other careers
9 Other, please name _____

		Lowest ranking				Highest ranking
2.	I usually face problems head-on (squarely) and resolve them (or attempt to) rather than procrastinate or deal with other matters.	1	2	3	4	5
3.	I have the maturity and ability and am willing to put aside or postpone other interests that are incompatible or detrimental to the rigorous engineering program I am about to begin. (I may have to limit my social activities to 5 hrs/wk maximum.)	1	2	3	4	5
4.	I am able to commit myself to a task and usually keep to that commitment until I complete the the task. (I am motivated.)	1	2	3	4	5
5.	I participated in extra curricular activities and maintained a high GPA in my pre-university school experience.	1	2	3	4	5
6.	I am a well-organized person.	1	2	3	4	5
7.	I manage my time effectively.	1	2	3	4	5
8.	I complete and submit all my assignments on time.	1	2	3	4	5

PERSONAL TRAITS AREA

	Lowest ranking				Highest ranking
9. I work well independently (I do not need close supervision) and get my assignments done well.	1	2	3	4	5

UNDERSTANDING OF MAJOR/CAREER AREA CHOSEN

	Lowest ranking				Highest ranking
1. I clearly understand what I will have to study as an engineering/computer science major.	1	2	3	4	5
2. I know what kinds of jobs I will be eligible for once I graduate from my declared major.	1	2	3	4	5
3. I have discussed my chosen career with someone in that profession/line of work.	1	2	3	4	5
4. I have thoroughly researched my declared major/ chosen career.	1	2	3	4	5
5. I know what the employment outlook is for graduates in my declared major five years from now.	1	2	3	4	5

CHAPTER 7

Minority Engineering Student Organizations

by Joel Nossoff

California State University, Los Angeles

INTRODUCTION

Student organizations play a key role in a minority engineering program (MEP). They provide a mechanism for students to meet their own personal and academic needs. They can significantly enhance the educational environment in which the students operate. They give the students an opportunity to develop their interpersonal and leadership skills and to learn how to work within an organization.

This chapter discusses how to build strong and active student organizations. Included are sections on the purposes these organizations serve, organizational factors including possible structures and affiliations, typical activities which can be engaged in, and problems which may be encountered.

FIVE MAJOR PURPOSES

Within the program model presented in Chapter 2, there are five major purposes for the development of effective minority engineering student organizations: social interaction, professional development, career development, academic development, and service to the MEP and the community.

Social Interaction

We all need to belong to groups in order to gain peer acceptance and to give and receive love and friendship. We also need status, respect, and recognition; and these needs are satisfied only in relation to other people. According to Abraham Maslow, realizing one's potential (self-actualization) depends upon first meeting these social and ego needs.

Often, students coming to college have never had to deal with loneliness, isolation, and alienation to any great extent, because they had their families and friends nearby when they were in high school. Making friends was not necessarily a deliberate or purposeful activity, but something which accrued over time. Now, in a totally new environment, with complete strangers, students are sometimes overwhelmed by the loss of intimate contact with friends. In the worse cases, some students assume that this is normal and desirable at college, and adopt a "lone-wolf" style. Studies have shown that many Black and Mexican-American college students assume that one should study alone, and that group study is unethical. Others believe that being a "serious" student means avoiding social interaction. At the other extreme, some students have such strong social needs that they spend too much time playing, and they neglect their academic goals. Engineering students who do not associate with other engineering majors may not receive the peer support necessary to succeed in engineering. There is a specific culture to being an engineering student, in the sense that there are learned patterns of behavior, and those patterns are best learned within a social setting among successful engineering students. Minority engineering student organizations can provide the student the opportunity to meet their social needs, but do so within the specific cultural context of a success-oriented engineering environment.

Professional Development

The typical engineering curriculum is packed with rigorous courses in math and science which are designed to prepare students to be technically proficient engineers. However, some curricula do little to prepare students in other important ways to be an engineer. Such necessary skills as leading, organizing, scheduling, managing, cooperating, listening, reporting, and delegating are not addressed in the typical engineering curriculum; yet they are essential if minority students are to be promoted within the engineering profession.

Minority engineering student organizations should be viewed as laboratories for students to develop skills necessary to their success as professionals. Through involvement in the organization, they receive practice in real situations that help them to learn by actually doing. While organizing a snow-cone sale may not seem a high-level professional activity, it teaches the persons responsible to plan, to deal with making agreements, to delegate responsibility to others, to check assumptions, and to prepare a report to a larger group. The students begin to learn that such skills are necessary for even the simplest tasks, and, further, they begin to develop those skills by exercising them.

Career Development

Students who enter engineering often have vague, erroneous, or limited understanding of the range of

positions that engineers hold in the world of employment. They need assistance to differentiate among disciplines (electrical, mechanical, industrial, computer), among the various types of work (design, testing, sales, management, teaching), and among the various industries (utilities, large constructors, aerospace-electronics, aircraft). With exposure to role models, field trips, speakers, films, and the like, the student can better decide which areas to enter and is more likely to enter those fields knowledgeable and prepared. This exposure is also important to the freshman and sophomore student whose classroom experience may be relatively removed from engineering and who needs this contact to maintain a high level of commitment and motivation.

Minority engineering student organizations can provide the interaction with industry which helps the student to learn first-hand the expectations of employers, to learn about the engineering profession, and to plug into the network which is so helpful in obtaining employment.

Academic Development

Although many MEPs will provide tutoring, study groups, and study centers, student organizations can also provide an informal means for students to work together on their courses. The influence of successful upperclassmen as academic role models, tutors, or mentors is important, and is often designed into the MEP program. Student organizations can collect lab reports, test files, homework, and maintain a textbook loan service.

Student organizations can also set group challenge goals for average GPA, and use social pressure to keep students from letting down the organization. As mentors, upperclassmen can "adopt" a new student and establish a supportive personal and academic relationship. Some organizations schedule regular review sessions and study groups for members. Academic performance in coursework is the primary purpose of the MEP, and it must also be the primary purpose of the minority engineering student organization.

Service to the MEP and the Community

One of the strongest motivators for students involved in minority engineering student organizations is the desire to help others. It is part of the ethic of putting back into the community what you get out of it. Student organizations can be a vehicle for students to contribute to others and to feel valuable. They can, for example, organize high school visitations to motivate and recruit minority high school students; they can organize and host open-house and tour activities for the same purpose; they can volunteer to tutor or raise funds for scholarships.

Some Other Purposes

For the MEP which has not adopted the model presented in Chapter 2, or for the new MEP which has not fully developed all the program elements, student organizations can fill additional purposes. In the absence of an orientation course or study center, student organizations are an effective network to inform students about opportunities, activities, and events that are of interest to them and that may enhance their professional careers. If there is not a formal summer job program in the MEP, student organization members can be encouraged to share information about companies that have hired MEP students in the past. A small committee in the organization can meet with recruiters to obtain information about summer, co-op, and full-time employment opportunities.

STRUCTURES

Structure is a vital element in the success of any organization. If a minority student organization is to survive and provide service to the university, the community and its members, it must be well structured. The MEP director is in an excellent position to play a major role in the organizational structure of minority engineering student organizations. But some tact will be required.

In most instances, the new MEP director will enter a situation where the structure is already determined, and usually it is preferable to work within that existing structure if minority engineering students are already committed to it. If the structure is untenable or counterproductive, alternate structures should be explored with the students.

Combined or Separate Ethnic Groups

Depending on the nature of the campus, a single organization may encompass all underrepresented groups. This might be preferable where one or more of the groups is too small on that campus to sustain a separate organization or where the enrollment of all underrepresented minority students is so low that more than one organization is impractical. The political or social climate on campus may also necessitate one large, strong, and united group.

In many cases, however, a strong sense of ethnic pride is fostered by single-ethnic organizations and for that reason may be preferable, especially in an environment which is extremely hostile to minorities, or where it is important to the students to demonstrate the cohesiveness of their group. While there is the risk of creating a minority engineering "ghetto," sometimes the benefits of group acceptance outweigh the risks. Separate Black and Hispanic engineering student organizations are probably the most prevalent structures on campuses across the nation. Nevertheless, the presence of separate ethnic organizations does not preclude joint activities, and the MEP director can be a catalyst in creating such joint activities between organizations.

Exclusively Engineering or Math, Science, and Engineering

Some student organizations limit themselves to engineering majors, while others include students from math, science, and computer science disciplines in addition to engineering. While the size of the minority student population on campus may determine the viability of either structure, it is almost always preferable from the MEP director's point of view to have an organization which is exclusively made up of engineering students. The population is thus more homogeneous and more likely to be comprised of MEP students. Programs and activities will center more on the engineering profession (rather than on medicine, nursing, math), and the engineering school and industry supporters may feel that the organization is more properly focused.

Campus-Wide Ethnic Organizations

Some strong campus-wide ethnic organizations, such as a Black Student Union or MECHA (*Movimiento Estudiantil Chicano de Aztlan*) can be important for the political and social development of students. They do not tend to be focused on academics, and particularly not on engineering, so it is important to remember that they are not established to impart the culture (learned patterns of behavior) of successful engineering students.

ORGANIZATIONAL FACTORS

There are numerous resources available to aid in developing by-laws, constitutions, rules of order, and the like, and it is not our intent to repeat them here. Organizational requirements may be imposed by individual campuses, and these should be checked out. Most campuses have an office of student activities, student development, or student life, and these can be helpful in interpreting campus procedures and policies. Many such offices take a very assertive role in developing student organizations, and their assistance and resources should be tapped. It is important, however, that the organization be centered in the College of Engineering and not in the Student Union because the student identification should be with the profession of engineering.

Whatever the organization, it is essential that it be set up for maximum participation by the most people. A small group of highly efficient leaders is typical, but it is better to spread the leadership around for the professional development of more students and to ensure continuity of the organization. Although this will be discussed in greater detail in a later section, it is important to remember that organizational factors can often create problems which reduce the organization's effectiveness.

Most officers, especially presidents, are highly active people who like to get things done. Often they are elected to office because they follow through on assignments. These "doers" must then become delegators, and this is often a difficult transition to make. It may be appropriate to advise the president that the only work to be done is to help others organize their work and see that it is completed. By their style, the president and other officers can determine whether a small clique runs the show or whether opportunities abound for everyone.

The role of the president is to motivate officers and members by keeping them involved. In turn, it is the officers' duty to delegate tasks to the members. Motivation occurs from setting realistic and challenging goals to be achieved by the membership, and those goals should parallel the groups' goals as set out in its bylaws. For example, in a highly organized group, an officer heads a publicity committee and he/she delegates specific tasks to each committee member. When an event is to be advertised, one person draws the poster, another obtains copies, and each committee member takes ten posters to post in a specific building by a certain date. Another person may be responsible for advertising the meeting in the school paper. The result is that the students work together, more members are involved, and no individual is burned-out by overwork.

Student leaders need to learn that they are managers, and they need to learn to delegate responsibility to others. The surest way to delegate is to ask an individual to perform a specific task by a specific time. Committee chairs, whether of ad hoc or standing committees, need to organize around that principle. The American Community Gardening Association says it for all volunteer organizations:

> Most organizations have a small core of dependable but vastly overworked volunteers who have assumed many responsibilities. This core group usually remains small due to a winnowing out of volunteers who lack staying power and due to a pervasive belief that it is more effective and efficient to do it yourself. Teaching new volunteers can be time consuming and frustrating but the rewards can be profound and long term. Give others the chance to share greater responsibility and to experience the inner workings of your organization. Make this a top priority.

The success of business meetings is crucial to the viability of the organization. Meetings should not be too lengthly (no more than one hour to one and one-half hours), conversation should not be dominated by a few people, and an event (speakers, film) can be mixed with the business. If only one or two people are taking care of all the business at the meeting, it probably means that a broad range of the members are not involved in the day-to-day activities of the organization. Everybody who is doing anything should report on those activities at the meeting, so that everyone participates and knows what the others are doing.

Another organizational concern should be interac-

tion with other student organizations. Often there is an Engineering Student Council which consists of all the engineering student organizations. Minority engineering student organizations should be represented and active in that Council. Cooperative projects, fresh ideas, and opportunities for leadership can result. The same is true for Associated Student organizations, which often distribute student funds to clubs and organizations. It is not unreasonable to expect minority engineering student organizations to develop leadership to the point that minority engineering students become leaders in other student organizations, such as IEEE, ASME, ASCE, Engineering Student Council, and Associated Students. While this may seem to dilute the leadership of the minority engineering groups, it is generally a good trend and should be viewed as a major accomplishment, because it means the students are competent and confident to lead in less familiar circumstances and it advances their leadership skills and recognition. It also makes room for other students to move up to leadership within the minority student organizations.

NATIONAL AFFILIATIONS

Just as other student organizations such as IEEE, SWE, and Tau Beta Pi are affiliated with national organizations, there are national organizations with which minority engineering students can affiliate. An individual or a chapter may choose to affiliate with one of these organizations. The degree of involvement with the parent society often depends on the priority that organization places on student involvement, the proximity of its headquarters to the university, and the students' perception of the desirability for interaction. The parent organizations can be extremely helpful in achieving the goals of the minority engineering student organization. They can provide role models, technical assistance, opportunities for leadership on a regional and national scale, scholarships, financial assistance, and other benefits. Some publish regular newsletters and some actively develop and support student chapters.

Affiliating with a national organization may create opportunities to attend national or regional conferences, during which students can exchange ideas and assist each other with developing creativity. Another important result is that students are energized and highly motivated to return to their organization and strengthen it.

SHPE (pronounced "ship")—The Society of Hispanic Professional Engineers is a national professional organization currently having eight regional professional chapters (Dallas-Fort Worth, Austin, San Francisco Bay Area, San Diego, Chicago, Colorado, Los Angeles, and New Mexico) and over thirty student chapters. SHPE has put much effort into developing student chapters and has been very successful at doing so. SHPE encourages each student chapter to have a faculty advisor and an industry advisor, the latter frequently being a local Hispanic engineering professional. This close contact with professionals makes SHPE effective in providing positive role models. The SHPE foundation has awarded thousands of dollars in scholarships to students, and each year SHPE has an annual Awards and Installation Banquet (July) and Career Fair and Career Development Seminars (February), both held in Los Angeles. Student involvement is high, especially at those campuses close to the national offices or near a professional chapter. Though it is an "Hispanic" organization, the membership is largely Mexican-American, and it is not as well established in areas with high Puerto Rican (New York, Puerto Rico) or Cuban (Florida) populations. A national newsletter is published every other month. (Contact SHPE National Headquarters, 670 Monterey Pass Road, Monterey Park, CA 91754, Telephone (213) 289-6231).

MAES (pronounced "my-s")—The Mexican American Engineering Society is also a national professional organization, though with no local professional chapters and fewer student chapters than SHPE. Their main activity is the MAES National Symposium held each spring, at which technical topics and subjects concerned with the education of Mexican Americans in engineering are discussed. Students are invited. No newsletter seems available, and there is no paid staff. (MAES Address: P.O. Box 4866, Albuquerque, NM 87196, Telephone (505) 345-5098).

NSBE—The National Society of Black Engineers is a national student organization with 102 chapters distributed in six regions of the country. A national meeting is held annually. *Umoja Sasa News Journal* is "the endorsed publication of the Northeastern Chapters of the National Society of Black Engineers," and is highly professional (*Umoja Sasa*, 512 East State Street, Ithaca, NY 14850, Telephone (607) 272-0995. The NSBE National Office: 915 15th Street, N.W., Suite 600, Washington, D.C. 20005, Telephone (202) 628-1093).

AISES (pronounced "aces")—The American Indian Science and Engineering Society is a national professional organization which develops student chapters at colleges, community colleges, and high schools. It puts out a newsletter and sponsors conferences, educational films and literature, professional meetings, and pre-college science fair programs. A well-developed *Student Chapter Handbook* is available. AISES has a full time Executive Director. (Contact AISES Executive Director, 1310 College Ave., Suite 1220, Boulder, CO 80302, Telephone (303) 492-8658).

TYPICAL ACTIVITIES

Many of the activities of minority engineering student organizations may not seem directly related to the goal of increasing minorities in engineering. The MEP director may be pushing for more intragroup tutoring, high school visitations, and activities related to academic development. The students may in fact be more oriented towards bake sales, parties, and picnics, which are more related to the social purposes of student organizations. All of these purposes are important, and a balance must be found.

Following is a list of activities and projects which have been undertaken by minority engineering student organizations:

Fund Raisers—These include dances, parties, bake sales, car washes, raffles, T-shirt or button sales, jog-a-thons, and banquets.

Career Days—Employers are invited to meet with students to discuss career, summer, and co-op job opportunities. Many employers are willing to pay a reasonable fee to cover costs of the event plus a profit for the organization. Workshops can also be presented on resume writing, interviewing, employer needs, and so forth.

Resume Books—A book can be put together of resumes of students seeking career, summer, and co-op job opportunities. This is then offered for sale to employers or included as part of the package for the Career Day fee. It should be noted, however, that employers are increasingly being asked by student groups to pay exorbitant fees for career days and resume books. They are beginning to pick and choose those which are best presented, which present the best or most students to them, and which help them fill their employment needs.

Field Trips—Visits to local industry are important career development activities, and although employers may prefer seeing students who are close to graduation, good field trips strongly enhance the career development of freshmen. It is important to let the employers know what kind of group is visiting, so the presentation can be tailored. Beware of tours that merely point out important buildings. Students should have the opportunity to meet with minority engineers to discuss their attitudes, experiences, and work.

Speakers—Engineers and other industrial representatives can come to campus to make presentations about their projects, their employers, or themselves. Minority engineers are often very articulate and inspirational role models for the students.

Banquets—Some student societies hold annual banquets to initiate new members, inaugurate new officers, present awards to students, recognize corporate supporters, and present scholarships. These can also be fundraisers, with tables sold to corporate supporters.

Awards, Scholarships—Funds raised by projects or contributions can be used to buy plaques for outstanding students, outstanding members, and corporate supporters. Scholarships can also be established for incoming freshmen or for continuing students.

High School Visitations—Minority engineering students can arrange to visit high schools to meet with minority high school students to inform them about opportunities in engineering, and about college admissions requirements, and to recruit students for the MEP. Acting as a concerned role model is a rewarding way for a student to return something to the community. When recruiting, the MEP director should remember the value of involving MEP students who may have graduated from the high school being visited.

Open House - High School Days—As an alternative or a follow-up to high school visitations, high school students can be invited to visit the campus, tour facilities, sit in on a typical class, and see demonstrations by students in engineering labs. Sometimes the student organizations will provide lunch and transportation for these events.

Welcome Picnics—At the start of the school year, new students can be welcomed at an informal pot-luck picnic organized by the students.

Contests—Essay contests or paper airplane, toothpick oil derrick, egg-drop, truss, or other technical contests can generate enthusiasm and group spirit.

Engineers' Week Activities—The minority engineering student organization can assist with planning and implementing annual Engineers' Week activities on campus.

Study Sessions—Prior to mid-terms and finals, students can gather to study together, with refreshments provided by the organization.

Test/Note Files—Students can place copies of tests, class notes, syllabi, and lab reports in a central file. When creating such a file, it is important that A and B level materials be retained as examples of superior work.

Seminars and Workshops—These can be organized around technical topics or about resume writing, interviewing, and job-search strategies. Career development and professional development topics are often popular, and frequently employers are prepared and eager to make these presentations.

Buddy System—Each upperclass student can "adopt" a new student at orientation before the fall term. They can exchange telephone numbers and agree to meet a set number of times. The upper class student is responsible for introducing the new student to friends, making party invitations, and other activities. They may study together.

National Society Meetings—Students can organize

trips to the annual events hosted by SHPE, NSBE, MAES, AISES. Funds can be raised to send delegates. Sometimes the national society or corporate supporters will underwrite such trips. These are excellent opportunities for students to share what they are doing, get new ideas, and make professional and career contacts.

The preceding is meant as a list of typical activities and should not in any way limit an organization. While a great deal of space could be devoted here to specific approaches to these activities, local circumstances vary too much for any one approach to be generally useful. Nonetheless, once an organization decides on an activity, the advisor should take part in the planning. Experience shows that students typically underestimate the planning and work that a successful project demands.

TYPICAL PROBLEMS

A number of potential problems can reduce the effectiveness of a minority engineering student organization. However, their effect can be reduced or eliminated if they are anticipated. Some of these problems may appear in any organization; a few are specific to minority engineering student organizations. Here are a few of them. With a little experience you can add to the list.

Continuity—This plagues many student organizations since most members are involved no more than four years, often less. Groups often start from scratch each year on a project that has been repeated annually for the last ten years. "Who has the stationery?" "Where is our banner?" "Who gave us money last year?" "How do we set up a Career Day?" These are common questions in an organization made up primarily of students. When there is continuity in an organization, the experience of previous years can be improved upon rather than reinvented.

It is the primary role of the advisor to assure organizational continuity. New officers can be briefed, material stored, records kept and information passed on by the advisor, who should be a stabilizing influence in a necessarily transitory organization. A desk, locker, or cabinet should be provided for student organizations, preferably in the MEP study center or MEP offices. The advisor should keep copies of calendars, posters, letters, minutes, and agendas, and should produce them whenever appropriate to a project. For example, a highly successful letter inviting corporate representation at a career day should be used as a model each year, rather than written from scratch. Energy can then be put into sending more such letters or into expanding the career day. This is also an important lesson in the students' development, teaching them that they should not "re-invent the wheel" but rather fine-tune and improve it.

Seniors as Leaders—Typically, seniors assume top leadership of student organizations. When they graduate they abruptly leave a vacuum of knowledge and experience. Continuity suffers, and the organization must develop new leaders. Beware of the student who is elected to a one-year term in the semester of graduation. The student may never complete the term of office. Also, seniors at some schools have excellent opportunities for part-time jobs in industry, and this can drain the senior leadership base rather quickly. Futhermore, freshmen and sophomores, denied leadership opportunities, may lose interest in the organization.

The Business Meeting Syndrome—Some groups meet too much and do too little. As a result the members get bored and cease to participate. It is never too early for students to learn how to run an effective meeting. A way to avoid this syndrome is to concentrate on projects rather than on meetings and to use meetings only to decide on projects, assign responsibilities, and receive progress reports.

Cliques—Too often a small clique runs an organization, in effect shutting out others, especially newcomers. This stifles organizational growth and the development of new leaders. The important thing to remember about a clique is that it is unintentional; no clique member consciously wants to exclude others. A sure sign of a clique is that new members or visitors are not systematically introduced to everyone, or no one asks a new person to participate in a project or comment on an idea. Few situations are as frustrating as seeing a group mount a highly effective member recruitment campaign, only to have new people ignored when they show up. The natural shyness of a new person in an organization is often ignored by members who naturally gravitate towards those they know already. They do not know they are excluding the new person, and this can usually be changed by a constructive suggestion from the advisor.

Communications—Organization communications are difficult when officers are students whose addresses and telephone numbers change every year. Mail sent to officers' homes is often mail never received by the organization. How does a corporate representative confirm a speaking date by phone when the student is never home during regular business hours? What happens when last year's officers are getting this year's mail?

If a staffed office with a phone is not available to the student organization, the mailing address should be "c/o Minority Engineering Program" and the telephone number should be that of the MEP. An organization mailbox should be provided in the MEP office, for both mail and telephone messages. Whenever possible a telephone should be available for organization business. All correspondence—including that of banks, creditors, students, national societies, corporations—should use the MEP address to contact student officers. To build an excellent communications

network, it is vital that leaders of a minority engineering student organization be in touch with MEP staff on a weekly basis, or more often.

The Resume Builders—Beware of students who run for office so they can put it on their resume and who have no real intention of serving the organization.

The One-Person Organization—Beware also of the dynamo leader who accomplishes a lot independently but who leaves the organization adrift because of never working to develop the organization, never developing other leaders, and never sharing with others the methods used to accomplish such good results. These people often get a lot of recognition and praise, make lots of industry contacts, and get good job offers at the expense of the organization's future effectiveness.

The "Professional" Member—Some students have such strong personal and social needs that they spend excessive amounts of time and energy on student organization activities. Often the academic performance of these "professional" student organization members suffers. Students who take on significant leadership roles or who tend to devote excessive time to student organizations should consider taking a lighter than normal course load.

Independence Issues—Sometimes the development of an MEP will follow the start of minority engineering student organizations by several years. Certain "turf" seems established; activities and programs have already been started by the students. Tutoring may already go on, and a study center or office may be committed to the student group. When the MEP starts operation, resources may be redirected from the student groups. Instead of students forseeing a cooperative, symbiotic relationship, they may perceive the MEP director as competition, or an outsider, or "the administration." In wanting to become advisor to the organization, the MEP director may be seen as replacing an old and trusted friend, the old advisor. Problems of territoriality are sensitive and take time to work through. The best approach is to allow time to pass, while remaining open and available to students. Students should be included in planning for a new MEP. A student advisory board can be set up, or students can be included on the MEP advisory board.

If a difficult situation is encountered, the MEP director should keep in mind that after several years, leadership of the organization will be with students who entered the MEP as freshmen and who do not perceive territorial differences between the MEP and the organization, because they never experienced them. In the interim, it is important that the MEP director not assume a defensive stance which is territorial in itself.

THE ADVISOR

The advisor to the student organization should either be the MEP director, someone on the MEP staff, or a faculty member. In any event, the advisor should be in close communication with the MEP staff. The personality, professionalism, and effectiveness of the advisor are more important than the person's university affiliation; but an optimum choice would be a minority faculty member in engineering. Although some campuses have professional activities advisors, primary responsibility for advising minority student organizations should not rest with that person. The advisor should be someone affiliated with the school of enginering who is able to relate specifically to minority engineering students.

As stated before, the primary responsibility of the advisor is to provide continuity to the organization. Another important responsibility is to keep the organization operating within the context of the goals of the MEP. The advisor can also assure constructive interaction with industry and with the School of Engineering faculty and administration.

Role and Attitude—The advisor should pay attention to the process of decision making and to the functioning of structures within the organization. This means focusing in on how the organization works as well as on what it does. The advisor is just that, an advisor and not a leader; a coach, not a quarterback. Students must be given the opportunity to fail and to learn from failure. There are stages in the early development of an organization when the advisor has to be aggressive and even has to lead in order to assure the viability of the organization; but there comes a point when the advisor must pull back and observe, advise, and listen.

Rules, Regulations, and Resources—The advisor and the MEP should also serve as a source of information about how to get things done on campus. Rules, regulations, and resources related to funding, publicity, scheduling, and facilities should be familiar to the advisor, as well as to whom to go in order to get around institutional constraints. These matters can often be handled by working closely with the professional activities advisor, usually in the dean of students' office or in the student union.

Active Participation—The advisor should be an active participant in most organization activities, even if not involved in planning them. The less organized the group is, the more the advisor should participate, especially in the formative stages of the organization. The advisor should attend meetings, buy at bake sales, make an appearance at social events, and generally show strong support for the organization. The level of an advisor's participation can be reduced at times when the organization has good momentum and leadership, but these must be constantly monitored.

INTERACTION WITH INDUSTRY

In order to fulfill their career development and professional development purposes, minority engineering student organizations should work closely with those industries and employers who are interested in hiring minority engineers. Most companies are eager to do what they can to increase the number of engineers from underrepresented minorities. They are also concerned that those engineers graduate with a high level of technical competence and professional skills. They want employees who can read, write, speak, lead, delegate, create, organize, plan, and schedule. They are often able and willing to deliver that message to students and to assist the MEP in the development of those skills. Employers are also willing to further the career development of MEP students by providing speakers, field trips, films, and the like, to inform students about career choices for engineers.

Naturally, employers who assist student organizations with career development and professional development activities do so partly to aid in recruiting qualified minority engineering graduates. Some companies will ask to set up events and contacts only with graduating seniors. The more forward-looking companies will assist the MEP and minority engineering student organizations in the career development and professional development of MEP students at all levels, including freshmen. They realize that working to develop more minority engineers is a better long-term strategy than merely trying to recruit the few now graduating. They also realize that developing visibility and bonds early in the students' education is more likely to gain those students' attention at graduation time. The MEP director and the MEP student are more likely to respond to the career recruitment efforts of an employer who provides summer jobs, field trips, speakers, and scholarships than to one who only shows up to recruit students at graduation. Those employers who participate in producing more and better minority engineers are more likely to benefit from those efforts.

Industry can and should be called upon to assist minority engineering student organizations with resources. The advisor or MEP director can function as an intermediary to bring them together, but it is important for the students to do the asking. Corporate supporters typically have provided these kinds of resources.

- Purchasing seats or full tables at banquets and contributing some of them to the students
- Typesetting and printing of stationery or newsletters
- Funding for students to travel to regional and national conventions
- Scholarships
- Cash gifts designated for specific projects
- Cash gifts for undesignated uses
- Field trips, speakers, films
- Surplus furniture and equipment for organization use
- Purchasing resume books produced by the organization
- Participating in Engineering Career Day
- Providing judges and prizes for contests

Industry representatives can also serve as industry advisors to the organizations.

It is extremely important for students to recognize and show appreciation for any support provided by industry. Whether a simple note of thanks or an elaborate plaque, recognition goes a very long way to convince a company that its contribution is worthwhile and worth repeating. Follow-up is very important.

Corporate interaction with student organizations must be a two-way street, and companies must not feel they are being exploited. This is especially true because they often have so much more to offer than just cash, and it is often the intangibles (such as advice, role-models, expertise, caring) which can be of the greatest value to students.

In their interactions with industry, students not only learn about their own chosen profession, they also gain important practice with communicating, they make important contacts for their careers, and they begin to act as professionals in a professional climate. Just as there is a culture (learned patterns of behavior) for successful engineering students, so is there a culture for successful professional engineers. The graduating student who shows up to an interview already exposed to that culture will have a distinct advantage.

CONCLUSION

The aim of this chapter has been to show the major purposes for minority engineering student organizations and to illustrate some typical ways in which the organization can function to meet the needs of the MEP students for social interaction, professional development, career development, academic development, and service activities. Some considerations related to structure, organization, and affiliation have been presented, along with some typical activities and some problems encountered by the organizations. The role of the advisor and the means for interaction with industry have been discussed.

It is hoped that this chapter has convinced the reader of the importance of developing effective minority engineering student organizations, and that some specific assistance has been provided to help in accomplishing this goal.

CHAPTER 8

A Model Academic Support System

By Uri Treisman

University of California, Berkeley

INTRODUCTION

Far too often, minority students who enter college aspiring to careers in science do not survive introductory calculus, physics, and chemistry courses. These intellectually rigorous courses, which are the foundation for further work in technical fields, are difficult even for the well-prepared student unencumbered by the multiple adjustments to college life that minority students typically face. Yet traditional remedial and counseling approaches have rarely achieved significant results in assisting these students through the crucial first year of college, or, as important, in increasing the number of those who complete a professional math/science-based curriculum, such as engineering.

This chapter describes the math/science workshops* at the University of California, Berkeley, which since 1978 have served a majority of the Black and Hispanic freshmen enrolled in Berkeley's introductory mathematics and science courses. Instead of providing remediation, the workshops constitute a novel honors program that promotes academic excellence and fosters leadership skills. The program has dramatically affected not only the performance of its participants in their beginning courses, but also their persistence in the university (see the Appendix at the end of this chapter for selected data).

The main principles that distinguish the workshops from other academic support activities will be outlined; the methods that have proven effective will be presented in some detail. It is important, however, to keep in mind that the program has evolved through trial and error. It has been revised, refined, and re-evaluated throughout its existence in order to tailor it to the individual requirements of minority students at Berkeley. Therefore, what follows is offered with the understanding that any program that institutes similar workshops must, of necessity, undergo similar experimentation and adaptation to suit its own needs and to make the best use of its resources.

* The Math/Science Workshop Program is a project of the Special Scholarship committee of the Berkeley division of the University of California Academic Senate. For further information about this project you may contact Uri Treisman, Associate Director, Professional Development Program, 230B Stephens Hall, U.C. Berkeley, CA 94720. Telephone: (415) 642-5881.

OBJECTIVES

The workshop program is designed to create an academic environment in which minority students can excel at college-level mathematics and mathematics-intensive science courses. Toward this end, it has four main objectives:

1. To build a community of minority freshmen that focuses on achieving academic excellence and that becomes a source of peer support;
2. To provide extensive, year-long supplementary instruction for minority students;
3. To orient minority students to the university and to assist their adjustment; where necessary, to advocate their collective and individual interests;
4. To monitor the students' academic progress and to furnish ongoing academic advising.

These objectives, of course, are interrelated. Workshop leaders keep formal instruction to a minimum, while enabling students as much as possible to learn for themselves and from one another. Consequently, the sense of community and the resulting peer support that minority students establish in a workshop are fundamental to the process by which they achieve academic excellence.

Because workshop leaders meet with their workshops several times each week, they can easily monitor their students' academic progress and adjustment. Thus, they can offer timely advice on the spot. Unlike university counselors or advisors who typically see students only when they are in trouble, the workshop leader can address problems in the making—such as housing arrangements gone awry or delayed financial aid—before they become crises. When a student shows early signs of needing further tutoring, the leader can make the appropriate referrals. The program staff cultivates good working relationships with EOP, affirmative action, and tutoring center staff members, as well as with interested faculty members, so as to coordinate the assistance available to workshop participants.

THE RATIONALE FOR WORKSHOPS

The idea behind a workshop program is that, under the guidance of a skilled teacher, minority students can learn mathematics and science more efficiently by working together with their peers. Many freshmen

unhesitatingly embrace the notion of working together, forming groups outside of class to do homework problems and to prepare for examinations. Students in such groups commonly pool their knowledge and their know-how, encourage one another, and find some time in a hectic schedule to relax sociably together.

Minority students, however, tend to be isolated from their classmates. In many cases they have achieved academic distinction in high school by keeping apart from less ambitious students and putting in long hours of solitary study. Although the self-reliance that has propelled them to college remains an invaluable attribute, in a workshop they can gain the benefits, both academic and social, of group study. Discussing the course material can uncover misconceptions about how well they have been understanding the lectures and textbook. Comparing approaches to solving problems exposes them to a variety of methods. Assessing their preparation vis-a-vis that of their peers helps them to develop realistic attitudes about what they must do outside of class in order to succeed. Working together in a friendly, cooperative setting can offset the pressures of highly competitive classes.

Despite the benefits that can be enumerated to prospective participants, a workshop program will not appeal to entering minority students if they perceive it to be essentially remediation under a new name. Even though they may be coming from high schools where they were insufficiently prepared, they usually have outstanding high school records. Thus, they are not inclined to view themselves at the outset as needing remedial assistance. Those students who are less prepared than classmates from superior high schools, however, may not recognize their deficiencies until midterm or later, when they perform poorly on an examination. At this point, it is unlikely that tutoring will enable them to make up lost ground.

A workshop program should be considered an honors program both in name and in fact. The students take up difficult problems, and the pace is challenging. When students discover that they need further help or that they are weak in a particular area, they receive individual assistance. This assistance can take place either privately during a workshop session or in supplementary sessions with a tutor. Yet, because in the workshop the student continues to tackle new material at a high level, remedial effort becomes part of a larger goal—not merely to catch up but to excel.

Traditional remedial programs differ from a workshop program in this important respect: remediation merely aims at bringing a student up to a passing grade in order to get through the course. Specialists in learning difficulties identify and address the weaknesses that will prevent a student from earning a "C." But a student who barely scraps by in first-semester calculus will go to the next course in danger of falling behind again. The operating assumption of a workshop staff is that the students are capable of honors grades—that they can earn "A's." Remediation can be accomplished along the way to successful performance. Rather than emphasizing weaknesses, the program builds on the strengths of its students: motivation, determination, high personal standards. But instead of pursuing their goals in isolation, the students can join forces, thereby helping themselves and each other.

HOW A WORKSHOP OPERATES

A visitor to a workshop session might initially mistake it for a noisy study hall where the instructor has temporarily stepped out. Most of the students are talking, some are getting up to look at other students' papers, some appear to be joking. A few are quietly working on a problem, ignoring the buzz around them.

But after a few moments the impression of disorder evaporates, and the purposeful nature of the activities becomes clear: the leader is circulating unobtrusively, alert to the dynamics of the clusters of students, all of whom are wrestling with a set of problems on a worksheet. From time to time, the leader will sit down, a short distance behind a group of three or four students. If they have no questions, the leader will observe them without commenting. If they have hit a snag, they may ask for a hint as to how to proceed. Moving from group to group, the leader can constantly monitor the students' progress by watching them in the act of solving problems.

A workshop is not just a place where students gather to study outside of class, nor is it an extra recitation section. Usually the leader will instruct the workshop as a whole only during the last twenty minutes of a two-hour session. During the rest of the time, both the students and the leaders have carefully defined responsibilities for making the period of group study productive.

The Students' Responsibilities

The students are responsible for attending regularly. Sporadic attendance not only would diminish the absent student's opportunity to profit from the workshop, but would also undermine the sense of community that the workshop is intended to encourage. A student must call in to explain the reason for missing a session—illness or perhaps a test in another subject the next day. Although the best students may correctly decide that they do not need to come to every session, two consecutive absences often indicates that a student is not on top of the material and is having difficulty with the course.

Before attending the workshop, the students are responsible for doing all the classwork they are able to do on their own. They should come with as much of the homework completed as possible, having read the assignments and reviewed their lecture notes. They can then participate actively in the workshop. If the student comes to the workshop unprepared, it will be

apparent to the workshop leaders.

During each session, some time can be spent on homework problems, and students can request help with the problems they have not completed. Some of the worksheet tasks will be devoted to breaking down homework problems into manageable steps. But the main purpose of the session is not to do course assignments but to reinforce concepts and skills by doing extra work: problems xeroxed from old tests that treat material now being studied, extensions of homework problems that introduce more advanced topics, problems that will lead into the planned instruction for the last portion of the workshop.

The worksheet is the vehicle for involving the students in groups, but there are no fixed rules about how they must proceed. Some will elect to start off alone, joining others after a period of quiet thought or exploratory attempts at a problem of their choice. At any one moment, different groups will be discussing and working out different parts of the worksheet. The composition of the groups may vary at each meeting, and within a session individuals may spend part of the time in one group and then leave to work with another. As they work together, they alternate giving and receiving assistance. Since the problems are designed to be tough, there is no stigma attached to asking a fellow participant for help, and the students quickly appreciate the chance to compare papers to see the methods and approaches others take to the same problem.

The students are responsible for critiquing one another's work. To do this, they must become more articulate critics than they are usually accustomed to being; they must refuse to accept an answer unless they can see why it is correct. It is not unusual at the first sessions for the students in a group to be impressed by one member who is particularly assertive, even when wrong. Nor is it atypical for several students to insist they have the same answer when they are patently at odds. The desire to agree—and to be agreeable—overrides their critical perceptions. But as they continue, they learn to question and to demand explanations. Then they are more ready as well to defend their own ideas.

The Leader's Responsibilities

Leaders must, of course, be thoroughly trained in the discipline that is the subject of a workshop. They do not, however, use workshop time to duplicate the sort of instruction the students receive from a teaching assistant in a recitation section. Instead of standing at a blackboard and demonstrating their expertise or taking the students step-by-step through examples, they design the tasks the students will work on, and they assist the students in learning how to work together.

Deciding what the students should concentrate on in each workshop is one of the leader's most important responsibilities. Observation of the students as they actually do the problems reveals that they need to expend more effort in certain areas without unnecessarily repeating already familiar procedures. The leader also frequently requests informal feedback from these students outside of the workshop.

The strategy in planning the worksheet is to keep the students challenged with tasks that they recognize as useful for their better understanding of the course material. The problems are set up so that students will get stuck or come to incorrect conclusions. Then the leader can offer obviously useful instruction. There is almost always a problem so difficult that no one can tackle it, and rarely is a worksheet finished. But at the end, when the students have all worked on some of the same problems, the leader will discuss them, often pointing out tricks that the textbook does not cover.

At a weekly curriculum meeting, all the leaders of workshops in one subject construct the worksheets for the next sessions. They analyze the course curriculum and the demands it makes on the students' mathematics background and problem-solving skills. They design the worksheet accordingly. Along with problems linked to the upcoming weekly homework assignment, worksheets typically include examples of confusing test questions, as well as problems that might look easy but that are quite difficult and vice versa. Putting together the worksheets for each week usually takes three to four hours. (See sample worksheets in Appendix B to this chapter.)

At every workshop session, before the students turn to the worksheet, the leader notes on the board the names of any who are missing. Late students erase their names when they arrive. Students volunteer information if they know why someone is absent. The careful record of attendance allows the leader to follow up quickly in the case of the student who has missed more than once. The leader may even go to the student's residence to find out why a student has not come and to offer help with any obstacles preventing attendance.

The first workshop meeting poses an especially delicate situation. Unless the students see at once that the workshop can be useful to them, they will not wish to commit to it the extra hours it demands. Yet they can fully appreciate the benefits only gradually. Therefore, the first time—and perhaps the next few times—the leader will operate more traditionally, giving the students some bits of instruction that they can apply directly. The worksheet for the first day is designed to convince the students that they have to work hard but that the effort will result in their doing well academically. They are presented with problems related to the first homework assignment that initially they cannot solve, but that they can do easily once shown how.

While the students are becoming accustomed to studying together, the leader will employ various tactics to sharpen their critical responses. One such exercise involves having two or three students redo another student's written problem solution. They are asked to

make small changes in language that they think will improve a test score. This task aims at showing them how to accumulate partial credit for style, even if they have a wrong answer.

At first, the students often discover that they are having a hard time communicating with one another. The leader may ask one member of a group to restate a concept more precisely or to explain in more detail the steps taken to arrive at an answer. By making their ideas clearer to the group, students clarify and reinforce their own understanding and find out what they have only superficially grasped. Paying close attention to how they express themselves also helps to improve how they will write on examinations.

In the course of monitoring the groups, the leader may react to a number of situations by taking a student aside for a brief period of intensive private instruction. If, for example, someone seems reluctant or is otherwise unable to begin, the leader can suggest practical techniques for getting started: writing anything that comes to mind, drawing a picture, listing facts, looking up definitions and similar problems. Individuals who are unhappy may be experiencing difficulty in adjusting to the university. In some cases, a student may be referred to a professional counselor, especially for example, if alcohol or recreational drugs are impinging on academic performance. The leader also encourages students who are not speaking up in a group to share their work and, thus, draws them out.

In the last portion of the workshop, after the students have struggled with the worksheet, the leader will go over some of the problems they have all attempted. They can then evaluate alternative approaches and isolate key techniques. At this time, they can raise questions about homework assignments and other concerns. To gain perspective on their efforts, they are asked to consider how the material they have been learning fits into the course as a whole.

Before examinations, the leaders will not only review sample test questions on the worksheets but also make suggestions to help the students organize their study outside the workshop: to figure out what should be memorized and what should not; to copy their lecture notes and fill in gaps; to reread the textbook; to check the textbook for clues to likely test questions. In order to develop their ability to allocate their private study time most efficiently, the students practice predicting what the test will look like—which questions will appear and how much certain questions might count in the grading.

The leader can also take responsibility for scheduling additional activities outside the workshop. Extra sessions can be spent on refining the reading and writing skills that are vital for academic success in mathematics and science: reading the technical language in which mathematical tests are written, writing homework, tests, and laboratory assignments in standard mathematical language and form.

As part of their continuing orientation, all the students in a workshop may attend cultural events on campus. From time to time, the leaders may arrange for them to sit in on a lecture in a subject far removed from their regular classes, such as art history of the Renaissance or ancient Turkish poetry. These breaks from the normal routine supply occasions for socializing as well as introductions to the varied resources of their environment.

SETTING UP AND RUNNING A WORKSHOP PROGRAM

A workshop program can be started with little in the way of special equipment—a few rooms containing movable desks or long tables and a board.

But some matters involve extensive planning: recruiting and selecting students; gaining workshop students' admission in a block to their classes and scheduling students into the appropriate workshops; attending to staff training and program development. Once a program has achieved a reputation for its participants' academic success, numbers can multiply rapidly, accompanied by increasingly complex administrative responsibilities.

Recruiting and Selecting Students

Students should be recruited during the summer before they enter college. Where there is an MEP program in operation, recruiting minority engineering students will be a normal component of the program. Where no MEP program exists, any college preparatory program for minority high school students, such as MESA, can identify candidates. In the absence of such sources, the names of target students can be compiled from admissions information.

A letter and possibly a follow-up call invite students to an orientation meeting. The orientation consists of an introduction to the workshop program explaining how the workshops function, followed by a pre-calculus test to assess the level of the mathematics course a student should take first. Together with the results of the test, the student's high school record, SAT scores, and a personal interview provide information to be used in selecting students.

By mid-summer, students are interviewed by a workshop staff member. The interview serves three purposes: (1) to reinforce the main points addressed at the orientation, namely, that this is a challenging honors program and that it will demand considerable time and effort; (2) to determine whether a student should be accepted into the program, based on high school performance and test scores, and also on a student's commitment; (3) to advise the student, whether or not the student is accepted, about appropriate first-term courses. The interview can also explore potential external problems that may hamper a student academically. At this stage, as well as throughout the year, it is important that the workshop staff be well-

informed about college and departmental requirements for various majors and other matters that can affect the advice given to students.

If, in addition to local students, potential participants are not in the area during the summer, the workshop staff may hold interviews at other locations. If this is not feasible, some last-minute interviews can take place when those students arrive on campus.

At the interview, students are strongly advised to take the minimum number of units during their first term. Typically, this strategy goes against the students' more ambitious inclinations. Especially if they are worried about financial aid, they will want to sign up for more rather than fewer credits. It is hard for them to estimate beforehand how much time they will actually be spending on studying outside class beyond the time spent in workshop.

The interviewers can point out, however, that once they have acquired a solid foundation, they can undertake a heavier credit load in following terms. Until then, should they have any free time, they can look into extracurricular activities—such as student organizations in their area of career interest—that can expand their awareness of future opportunities.

Placing Students in Workshops

One of the most pressing administrative tasks is to match students with courses and workshops. During the pre-enrollment period, the number of workshops to be offered in each course must be set, and the time each workshop will be held must be coordinated with the scheduled times for lectures, sections, and labs in a particular course. In order to construct the worksheets, prepare students for examinations, and otherwise tailor the instruction to course assignments, all the students in a workshop must be attending the same lecture so that they will have the same homework assignments and prepare for the same tests. If clusters of workshop students are in the same sections as well, they can give one another further support. Special arrangements to place workshop students into lectures and sections can best be accomplished when the workshop staff has established cooperative relationships with faculty members who endorse the program's objectives.

Enrolling students in courses and in workshops present similar complications in the second semester. Furthermore, whether to keep students together with the same leader and whether to admit new participants, and if so how to fit them in, are policy matters that will arise. Students who do not pass the fall course can pose a delicate problem. There is also the need to continue advising students about their options and about requirements.

Staff Training and Development

Given the untraditional role of the workshop leader, finding candidates who can combine tact and ingenuity in teaching with informed, sensitive counseling is of paramount importance. Graduate students often have too many commitments to their own work. A graduate program for mathematics and science teachers can be a better source. Also, talented undergraduates, especially if they have gone through the workshops, can become valuable assistants and leaders. A staff made up of faculty members, graduate students in education, and undergraduates can provide a mixture of new and experienced leaders in balanced proportions.

The initiation of new leaders should begin prior to the selection of students for the fall semester. A three-to-four day training session can introduce the program's principles and demonstrate teaching methods. New leaders can attend the general orientation and sit in with experienced staff members on the individual interviews for prospective students.

During the year, various activities can assist both new and experienced leaders in evaluating the quality of instruction. In addition to the weekly curriculum meeting to design the worksheets, leaders teaching the same subject should meet to discuss how best to present material, drawing on different staff members' expertise in particular areas of the curriculum. Leaders also can meet periodically to assess their performance. An individual can describe a difficult situation that has arisen—an instructional matter or perhaps an issue concerning the appropriate response to a particular student's case—for the leaders as a group to analyze.

In order to assess their strengths and weaknesses, two leaders can exchange workshops for a day. The visiting leader solicits from the students criticism and suggestions for the regular leader to consider about improving the instruction. The visiting leader can generate thoughtful analysis by asking each student to compile a list of what occurs in the workshop that is useful to the individual and to the participants as a whole and another list of what is least useful from these perspectives. The students can write their comments separately and then discuss them in groups, and the visiting leader can help them to focus on the most significant issues.

Students can have more opportunities for making suggestions and offering criticism if they are included on committees with leaders and staff members. The process of involving students at this level not only encourages constructive feedback from those directly affected, it can become an extension of the group problem-solving techniques that they are taught in the workshops. For the leaders there is the advantage of receiving student comments frequently throughout the year.

CONCLUSION

A successful workshop program is one in which the participants achieve their academic goals. The following charts document the remarkable success of the Math 1A (first semester calculus) workshops at Berkeley. Similar results could be shown for Math 1B (second semester calculus). The ultimate objective of any such program, however, extends beyond the freshman year of college. It is to develop minority students into independent learners who will go on to complete the major of their choice and begin graduate study or a career in the sciences, engineering, business administration, or other technical fields.

The record of the program's graduates at Berkeley compared to that of minority students who have not taken part strongly suggests that the workshops do contribute to students' persistence in the sciences and engineering. Having been through the workshop program as a freshman, however, does not guarantee that a student will sail smoothly through the next several years. Placing students with mentors—upper division students or even faculty members—can be helpful. There is room for further research and experimentation into the ways in which minority students can best be served during and after the first year of college. But results to date indicate that a workshop program can start them on the path to academic excellence.

APPENDIX

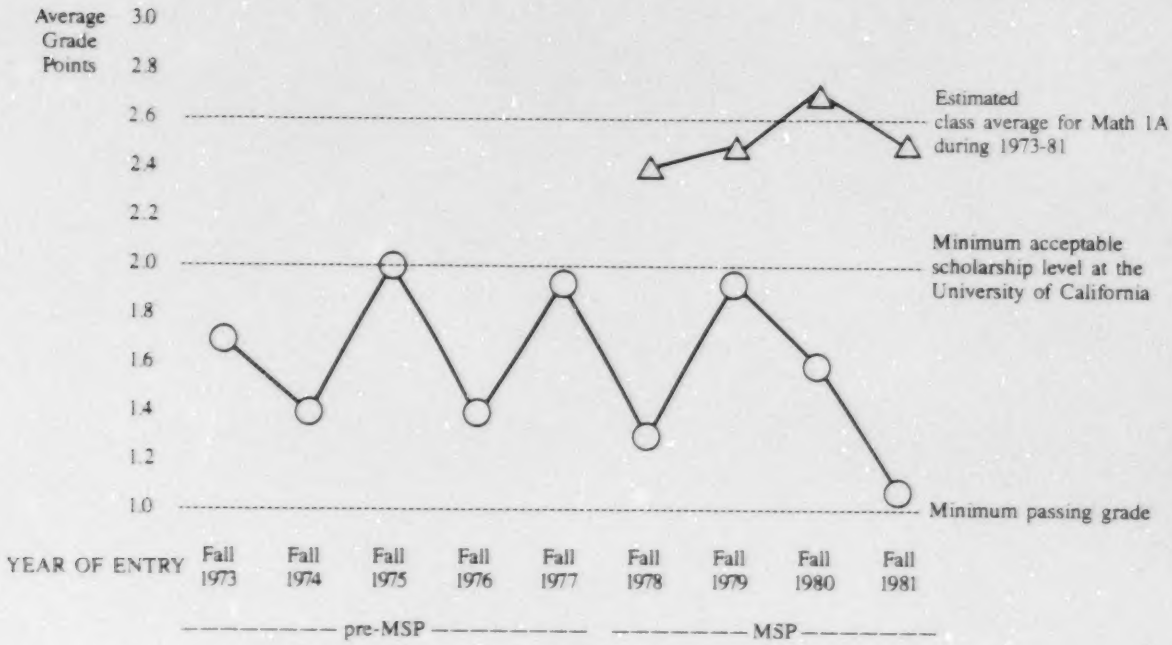
Selected Data

Evaluation has been a regular, ongoing activity within the MSP project since its inception in 1978. Results to date suggest that the project has been highly successful in meeting its goals. Despite large yearly increases in the numbers of both students served and subjects offered, MSP students have *consistently outperformed* their non-MSP minority counterparts in each of the project's target courses. Moreover, in many of these courses, the average grade of MSP students has been equal to or higher than that of their *non-minority* classmates.

Tables I and II show, respectively, the performance of Black and Chicano freshmen in Berkeley's Math 1A, and compare MSP and non-MSP students. This begins a rigorous two-year calculus sequence that plays a pivotal role for science and engineering students; it is a prerequisite for *all* engineering and physical science majors, and it is the preferred calculus sequence for business administration and biological science majors. Yet, as the charts show, in the five years prior to the creation of MSP, the average Math 1A grade earned by Black and Chicano students was between D+ and C−; the class average for *all* students during this time was between C+ and B−, a full grade higher. Equally important, but not reflected in the charts, is the fact that *more than one-fourth* of the minority students who attempted Math 1A *during these years dropped the course* before completing it, and therefore did not earn a grade. In contrast, with only two exceptions, every minority MSP student who has enrolled in Math 1A during the last three years has completed the course.

TABLE I

Performance of Black Freshmen in Math 1A, by Year of Entry into the University



YEAR	1973	1974	1975	1976	1977	1978	1979	1980	1981
MSP Students	—	—	—	—	—	25	28	39	40
Non-MSP Students	16	21	28	30	39	30	30	39	15

△ = MSP Participants

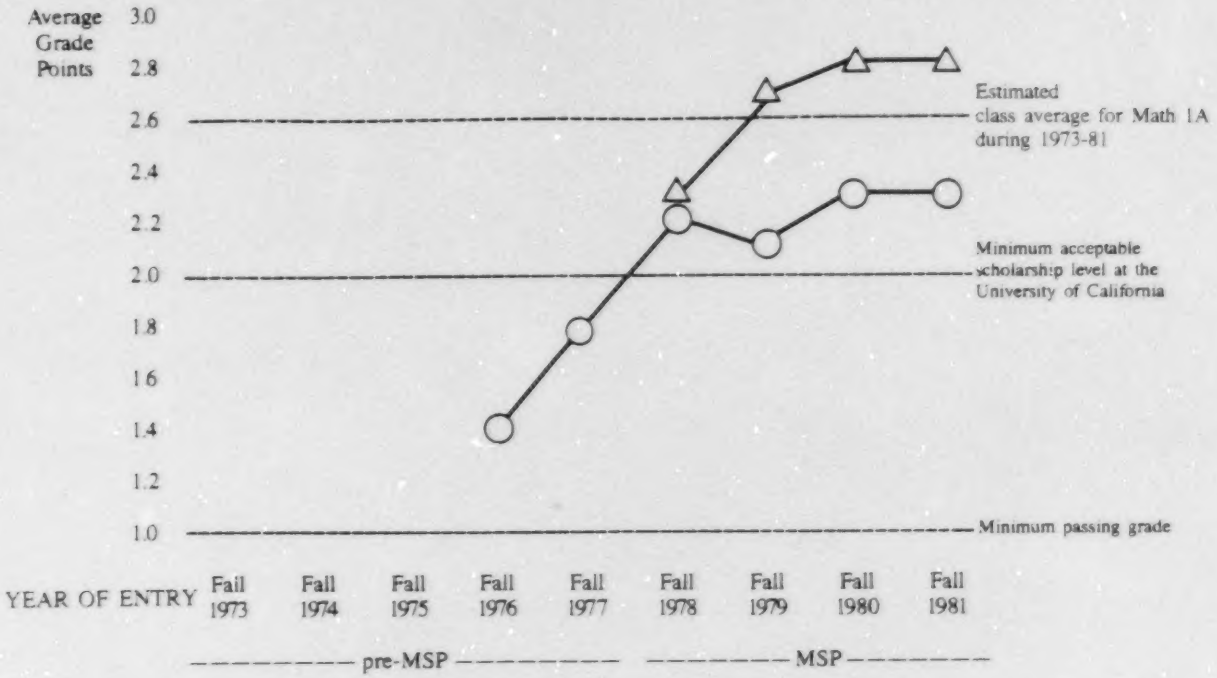
○ = Non-MSP Students

Average Math SAT score of Black MSP students in Math 1A during 1978-81 was 505.

Average Math SAT score of Black Non-MSP students in Math 1A during 1973-81 was 499.

TABLE II

Performance of Chicano Freshmen in Math 1A, by Year of Entry into the University



YEAR	1973	1974	1975	1976	1977	1978	1979	1980	1981
MSP Students	–	–	–	–	–	10	7	22	19
Non-MSP Students	–	–	–	15	15	26	20	25	25

△ = MSP Participants

○ = Non-MSP Students

Appendix B

A Sample Math Worksheet for Second Semester Calculus

MATH 1 B W.S. #32 PDP 1/16/84 pg.1

I (a) Which is larger: $\int_a^b \sqrt{1+(f(x))^2}\,dx$ or $\int_a^b f(x)dx$?

(b) Show that $\frac{1}{2} \le \int_0^1 x\sqrt{1+x^2}\,dx \le \frac{1}{\sqrt{2}}$

(c) Show that $\frac{\pi}{2} \le \int_0^{\frac{\pi}{2}} \sqrt{1+\cos^2 x}\,dx \le \frac{\pi}{\sqrt{2}}$

(d) Evaluate $\int_0^{2\pi}\sqrt{1-\cos^2 x}\,dx$ (Hint: the answer is not 0)

II. How many errors can you find? Which can be fixed?

Problem: Find the length of the graph of $f(x) = \ln \cos x$, $0 \le x \le 27$

Solution: $f(x) = \ln \cos x \Rightarrow f'(x) = \tan x$

$$\therefore\ L = \int_0^{2\pi}\sqrt{1+\tan^2 x}\,dx = \int_0^{2\pi}\sqrt{\sec^2 x}\,dx = \int_0^{2\pi} \sec x\,dx$$

$$= \int_0^{2\pi} \frac{\cos x}{1-\sin^2 x}\,dx = \frac{1}{2}\ln\left|\frac{1+\sin x}{1-\sin x}\right| \Big/_0^{2\pi} = \frac{1}{2}\ln(1) - \frac{1}{2}\ln(1) = 0$$

use $u = \sin x$, & use partial fractions

III (a) Let $f(x) = mx + b$ $\quad m > 0$. Using "similar $\triangle$'s" show that the length of the graph for $a \le x \le b$ is $\sqrt{1+m^2}\,(b-a)$. Check using arc length formula (*) $\quad L = \int_a^b \sqrt{1+f'(x)^2}\,dx$

(b) Use part (a) to explain why the arc length formula (*) is plausible.

IV. (a) Express the length of the graph of $y=\sin x$ $0 \leq x \leq \frac{\pi}{2}$ as an integral. [Do not evaluate]

(b) Argue "geometrically" that

$$\int_0^{\frac{\pi}{2}} \sqrt{1+\cos^2 x}\,dx > \sqrt{1+\frac{\pi^2}{4}} \approx 1.86$$ (compare with problem Ic.)

(c) Show that for $n \geq 1$ $\int_0^1 \sqrt{1+(nx^{n-1})^2}\,dx \geq \sqrt{2}$

(d) Evaluate $\lim_{n\to\infty} \int_0^1 \sqrt{1+(nx^{n-1})^2}dx$ (A picture is worth $2^3 \cdot 5^3$ words)

V. (a) Show that $ab = \frac{1}{4} \Rightarrow 1+(a-b)^2 = (a+b)^2$

(b) Find the length of the graphs of the following functions on the domains indicated.

(i) $y = \frac{1}{6}x^3 + \frac{1}{2x}$ on $[1,3]$

(ii) $y = \frac{x^4}{8} + \frac{1}{4x^2}$ on $[1,3]$

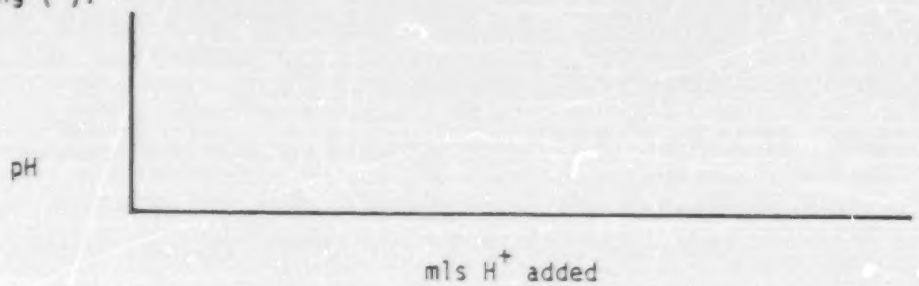
(iii) $y = \sqrt{1-x^2}$ on $[0,\frac{1}{2}]$

(iv) Do problem (iii) by another method.

1. 250 ml of 1.00 M NH_3 solution is titrated with 2.00 M hydrochloric acid. Fill in the Table below:

	mls H^+ added	pH	$[NH_3]$	$[NH_4^+]$
a)	0			
b)	66.5			
c)	99.75			
d)	125.			
e)	250.			

Draw a titration curve for the titration and indicate the buffer region using ( ).



If .01 moles of additional HCl were added to the solution in (c), what would the new pH be?

2. A solution is saturated with 0.300 M H_2S gas, (meaning it is 0.300 M $H_2S_{(aq)}$) What is the solubility of Bi_2S_3 in this solution?

K_a H_2S = 9.1×10^{-8} $K_{sp}Bi_2S_3$ = 1.6×10^{-72}

CHAPTER 9

Tutoring Programs and Student Study Centers

by Richard Ortega, **California State University, Sacramento**
and
Christine Reyes, **California State University, Northridge**

INTRODUCTION

This chapter focuses on two important elements of an effective minority engineering program (MEP)—tutoring programs and student study centers. These topics are related since a student study center is an ideal place to deliver tutoring services.

The primary need for tutoring is to support students in their first two years of engineering study. By addressing the core courses in the engineering major — math, chemistry, physics, engineering, computer science — an MEP tutoring program can help students make a successful transition from high school to college and give them a solid academic grounding for their upper division coursework. With most of the tutoring focused on the freshman and sophomore years of the engineering curriculum, students can become increasingly self-sufficient, needing little tutoring as juniors and seniors. An effective tutoring program thus helps students achieve self-reliance, builds their confidence, and paves their way to academic excellence.

The availability of a student study center can be a great asset to an MEP program. In addition to providing a place for tutoring, it is a place where students can gather for individual and group study and for meeting their interpersonal needs. A study center also becomes the communication center for an MEP program.

The following sections discuss tutoring program structures, selection and training of tutors, and administration of the tutoring program. The last section discusses the operation of a student study center.

TUTORING PROGRAM STRUCTURES

There are two basic ways to structure a tutoring program: either walk-in tutoring in which students receive immediate assistance on a "first-come, first-served" basis, or pre-arrangement in which students meet with tutors by appointment. Each format has its pluses and minuses.

A walk-in laboratory follows a definite schedule, with tutors in the laboratory at assigned times. Students are notified of these times and can seek assistance when they need it. Walk-in tutoring enables a tutor to see several students during an hour, or even help several students at once. But its major advantage is that it allows students to receive help as soon as they encounter a problem. A disadvantage of this system is that it can be too flexible. During his or her assigned tutoring period, a tutor might not see any students, thus wasting valuable resources.

In a tutoring-by-appointment system, a student makes an appointment with a tutor for a scheduled amount of time, usually an hour. Since students frequently require more than one tutoring session, the appointment system enables a student and tutor to meet regularly and get to know each other. Comraderie and rapport are likely to develop, as well as a keen sense of what each of the sessions should accomplish and what each of them must do to prepare. A disadvantage of this system is that a tutor's schedule can fill up, leaving little or no time for the immediate needs of other students. Also, appointments do not necessarily reduce idle tutor time. Even a "booked" schedule can occasionally leave tutors sitting idle if students, so caught up in their studies or confident about themselves and their coursework, do not show up for their appointments.

A tutoring program that takes the best of each approach, that blends walk-in tutoring and appointments, is probably most effective. The walk-in system guarantees that students can usually see a tutor immediately. Appointments, on the other hand, cater to students' longer-term and more demanding needs, providing uninterrupted blocks of time for one-to-one assistance and enabling those who need it to arrange for multiple tutoring sessions. (To prevent a tutor's time from being monopolized by just one or two students, and to reduce the occurrence of "no-shows," appointments should be scheduled no more than a week in advance.)

SELECTING TUTORS

The most important factor in a tutoring program is the quality of its tutors. The most practical source of qualified tutors is the math, science, and engineering student body. While it may seem ideal to have faculty serve as tutors, faculty tutors are generally difficult, if not impossible, to secure. A professor's time is costly, and most tutoring programs have modest budgets. Volunteer tutoring might work, but only a dedicated few will take on extra work with no compensation.

Students — graduate and undergraduate — can be

highly effective as tutors; in some ways they are preferred over faculty. Student tutors are essentially "peer" tutors. Close in age and only slightly ahead in their education, student tutors act as role models and even advisors for their tutees, in addition to providing help with their academic work.

The process of selecting tutors begins with the identification of a pool of tutor candidates. To create this pool, the tutoring program needs to be publicized to the university at large. Advertisements for tutors can be placed in the career planning and placement center, the work-study office, the personnel office, and if the budget allows, the campus newspaper. Job announcements can also be distributed to the department chairs and graduate advisors in the chemistry, physics, mathematics, engineering, and computer science departments and posted on bulletin boards in their vicinity. The university's office of admissions and records also may be enlisted to recommend outstanding students. Identified students can then be sent an application along with a letter inviting them to apply. MEP students in good academic standing should be especially sought, both to increase the number of role model tutors and to provide financial support to MEP students.

In inviting students to become tutors, the program should emphasize the benefits of the position. These include, in addition to the salary, the reinforcement of knowledge, the development of teaching techniques and skills, enhanced self-confidence and self-esteem, and the chance to help others. To attract the better students, the pay for tutors must be competitive. If money is tight, the hours can be limited; it is better to have good tutors working less than weak tutors working more. An attractive salary, coupled with a work schedule that accommodates the tutor's own classes, should elicit enough applicants so that the program coordinator will have the luxury of choosing only the best.

Criteria for tutors should be rigorous. They should include grades in the courses to be tutored, overall grade point average, faculty and staff recommendations, previous tutoring or teaching, and experience with and sensitivity to the needs of ethnic students. The last criterion demands a people-oriented tutor, someone with good interpersonal communication skills—qualities best displayed in an interview. During the interview, the prospective tutor can be asked to solve a problem, as if in a tutoring situation, so that the coordinator can judge his or her ability to explain things clearly and concisely. An interview will also reveal whether the prospective tutor has patience, an indispensable quality. An impatient tutor can so antagonize students that they may never return to seek assistance, no matter how poorly they are doing; and they will likely tell fellow students of their dissatisfaction.

TRAINING TUTORS

Even when the tutors selected are proven students and have strong interpersonal and communication skills, it is appropriate to provide them with training. They need to know about the goals and objectives of the MEP and its tutoring program, as well as their specific duties and responsibilities. They also need to understand the rationale behind MEP's tutoring efforts, so they can gear their tutoring to reflect this philosophy. Moreover, they need to know practical details, such as reporting procedures, evaluation mechanisms, and payroll deadlines. Finally, even the best tutors will benefit from studying ways to improve their interpersonal skills and overall effectiveness as tutors. For example, they need to understand that supplying correct answers does not really help students, whereas transferring problem-solving skills, an invaluable process, does help students achieve academic independence. Tutors can facilitate the transfer by having students apply the concepts and methods they learned. (See list of tutoring tips in the Appendix to this chapter.)

The tutor must also learn to accurately assess a student's problems and select the best approach to helping that student. Often the cause of a student's difficulties will be non-academic—poor time management, for example, or a language barrier—and may require assistance that the MEP tutor cannot provide. Tutors therefore need to be aware of other resources within the MEP or the university. Among these resources are academic or personal counseling, health services, and academic skills workshops.

Tutors must also understand the effects of doing their personal work on the job, even if they are unoccupied. By concentrating on their own problems, tutors convey the message that their own work is more important than the students' work, and some students will thus hesitate to approach them. Furthermore, tutors need to know when and how to take the initiative with students, especially with those reluctant to ask for assistance. They need to be able to empathize and acknowledge students' problems, yet be candid in their relationships with their students.

In the training program, the importance of tutors giving students positive feedback, both verbally and nonverbally, should be explained. Just as negative feedback will damage students' confidence and initiative, positive feedback will boost their self-esteem, motivating them to do well. Tutors, however, should not give praise unless it is warranted and sincere. Students can be very sensitive about asking for assistance and are quick to recognize insincere praise. Non-verbal feedback can be just as potent as verbal messages, and the body language that a tutor displays can easily encourage or discourage a student. By sitting next to the student, leaning forward, and listening attentively, the tutor creates an aura of collaboration, and the student is apt to be more relaxed and open

to learning. Confrontation positions, on the other hand, such as sitting across from the student, appearing agitated or impatient, not only put a student off but also make it difficult for the student to see anything the tutor writes.

ADMINISTERING THE TUTORING PROGRAM

With the tutors selected and trained, the next order of business is to establish a tutoring schedule, one combining both walk-in and appointment tutoring, and accommodating the largest number of MEP students. If, for example, most of the students' classes are held in the morning, then the bulk of tutoring time should be available in the afternoon. Evening and weekend tutoring should be scheduled only if enough students would use it. Generally, schools with a high percentage of commuting students will find that evening and weekend tutoring is not cost-effective.

Monitoring and Evaluation

Once operational, the tutoring program should be monitored regularly. A tutor log, listing the names and dates of appointments and drop-ins, plus subjects covered, is an effective way to keep tabs on the program, and to determine how well tutors are being used. An empty or near empty tutor log is a clear signal that something is amiss, either with the tutor or the schedule. Site visits, informal observations, and conversations with MEP students will also tell the program coordinator how the tutoring program is faring.

In addition to monitoring practices, the coordinator should periodically evaluate the program. The evaluations should address all aspects of the tutoring program, seeking both positive and negative comments. Tutors can be evaluated by the students using a tutor rating form, by the other tutors, and by the program coordinator. The program and the tutor's success can also be evaluated by examining the final grades of students utilizing the tutoring services. Still another important evaluation tool is the tutors themselves, who can likely make practical, informed suggestions for improving the program.

Student Attitudes Toward Tutoring

Despite careful monitoring and evaluating, a tutoring program may fail to serve a maximum number of students. This is not necessarily the program's fault; it may well stem from a distorted view of individualism which affects the students' attitudes toward tutoring and their coursework. Some students feel that there is a stigma attached to needing or seeing a tutor. Others feel that they must succeed on their own, without any help from anyone. Still others may be unaware of the extent of tutoring services offered. Furthermore, some students may be unrealistic about their need for help, insisting they can handle the load or have everything under control, when in fact the opposite is true. They maintain this posture even though their exam scores reveal otherwise.

Whatever the reason, such students can be taught to reconsider their assumptions about tutoring, and the astute program coordinator will take steps to correct these misconceptions. An ideal forum is the MEP freshmen orientation or other orientation program, so that students can be reached when they are new to MEP and the university. Upperclassmen in good academic standing or MEP alumni can be brought in to address the class, relating their own experiences with tutoring and encouraging the freshmen to take advantage of the program. A good argument in favor of tutoring is industry's growing trend to use grade point averages as an employment criterion.

Funding Tutoring Programs

The extent and scope of an MEP tutoring program depends, of course, on budget allocations. Since most program budgets are minimal, one way to stretch tutoring dollars is to search for and rely heavily upon student tutors who are eligible to receive college work-study funds. To supplement the budget, extra monies can be sought from the campus' student government organization or other sources. Campus-wide minority programs may be able to provide some type of assistance, especially if large numbers of their students are also MEP students. The success of these students reflects well on both programs and can alleviate some of the burden the larger program handles. The athletic department and veterans affairs office may also be sources for possible support. Finally, industrial sponsors of the MEP may be able to provide either monies outright or the use of one or two of their engineers to act as tutors. The program coordinator must be creative and thorough in the quest for funding for the tutorial project, especially if money is tight.

Space for Tutoring

Tutoring, especially "walk-in" tutoring, requires space. Although the tutoring can be conducted in vacant classrooms, laboratories, lounges, or even in the tutors' homes, there are clear advantages to having a permanent site. This site ideally should be in the engineering building and in proximity to the MEP office. The permanence adds an air of stability and importance to the program and enables the MEP staff to monitor the tutoring program. In a permanent site, resources such as chalkboards for group tutoring, copies of texts and syllabi, and files of old exams, homework sets, and laboratory reports can be readily provided. An MEP student study center of the type discussed in the next section provides an ideal place to deliver tutorial services.

STUDENT STUDY CENTER

A student study center can be a great asset to an MEP program. A study center provides a "home base"

for MEP students, a readily accessible place where they can feel comfortable and always find a friendly face. It is an important element in achieving the goal of building MEP students into a strong community. The study center also enhances the students' academic experience by providing a place for them to study both individually and in groups. As previously discussed, it is an ideal place to deliver tutoring services. Finally, the study center becomes the focal point for communications between MEP staff and students and among MEP students.

One of the most important purposes of a student study center is to provide MEP students with a base from which to operate. Rather than returning to their dorm room or apartment between classes or going to the student union, places which may not be conducive to study, the student who goes to the study center is more likely to study. One way to ensure that the students operate out of the study center is to equip it with lockers so that the students can keep their books and other equipment there.

Another benefit of the study center is that it promotes group study. Students who study there will meet other students and as they have problems will seek help from these students or from tutors. Furthermore, students are likely to do more studying in a situation where they can combine their social needs with their academic efforts.

The study center also serves as a communications center for MEP students and staff. MEP staff can post information about speakers, field trips, scholarships, summer or part-time jobs, or just a note that they need to see a student. In addition, the study center promotes communication among MEP students. In a well-used study center, the blackboards will be filled with messages from one student to another.

Finally, the study center can be a focal point for the minority engineering student organizations. Bulletin boards should be provided for posting notices of their activities. Meetings can be held there, but care should be taken to ensure that they do not interfere with other students studying.

The student study center should be centrally located, accessible, and of adequate size. In times of overenrollment and tight space, it may be difficult to acquire space which meets these requirements. Whether this can be done depends on the priority placed on the program by the engineering and university administration and on the effectiveness of the MEP director in convincing the administration of the importance of a study center. The best location is within the engineering building. Use of trailers, temporary buildings, or other "second-class" space should be avoided. Poor space will hamper the effectiveness of the MEP program, sending clear signals to the students about the administration's attitude toward them and the MEP program. Experience has shown that the size of the study center should be at least 400 square feet for each one hundred students served. Where tutoring services are delivered within the study center, it is desirable to have two adjoining rooms, one for group study and tutoring and one for quiet study. The study center should be accessible to the highest degree possible, ideally twenty-four hours a day, seven days a week.

Since the study center becomes a home away from home for the students, it should be comfortably furnished and adequately equipped. The need for lockers and abundant blackboard space has already been indicated. Study tables, chairs, and drafting tables should also be included. Couches, a refrigerator, a microwave or toaster oven, and an on-campus telephone will add to the utility of the center. Where they can be secured, computer terminals or personal computers will likewise be of benefit to the students.

CONCLUSION

Tutoring programs are effective when they are structured to meet the specific needs of MEP students, are well-planned, have carefully selected and well-trained personnel, and are closely monitored. A student study center can contribute greatly to the community building and academic support goals of an MEP program. The study center, in addition to being a place where students can be tutored and study with each other, provides a base of operation from which students can succeed in their academic pursuits. We hope that the material presented in this chapter is general enough to adapt to most institutions yet specific enough in describing components and procedures to ensure a successful program.

APPENDIX

TIPS FOR MATH/SCIENCE TUTORING[1]

The first objective of students studying math or science is usually to pass the course. The tutor's job is to help the student achieve his/her potential, but to do it in such a way that the student becomes ever more confident and independent. A tutor should continually ask him or herself, "Will what I'm doing help the tutee to master material *other* than this specific topic?" The emphasis on problem solving makes the tutoring of math/science quite different from tutoring other subjects, and the following guidelines might aid you.

LET THE TUTEE DO IT. The tutee should do most of the talking and nearly all the writing. The paper should be in front of the tutee and the tutor can help by asking questions, hinting, and encouraging. Let the tutee work out problems and make mistakes. It may take twice as long, but the learning will be four times as great.

EMPHASIZE STUDY SKILLS. Poor use of time and lack of good study habits are major shortcomings. Help tutees to master techniques that will make them efficient learners.

INCREASE MOTIVATION. If a student has enough enthusiasm and desire, then nothing can stop him/her. Bring out the tutee's interests and link them to the subject. Motivation, achievement, and confidence are inseparable.

FOCUS ON STRENGTHS. If a tutee is good at memorizing or visualizing concepts, or calculating, or organizing, then use that ability as a foundation. Everyone has a strength, and should be encouraged to use it. This builds confidence. If a tutee learns best by writing, reading, looking, touching, talking, hearing, or a combination of these, then that's the method he/she should use. Suggest to the tutees that they try reading their textbooks aloud.

TREAT THE DISEASE, NOT THE SYMPTOMS. If a student is being held back by something (math anxiety, lack of sleep, professor overemphasizing abstract concepts, poor study habits, inadequate math skills, etc.), then find out what it is and help the student with it. *Probe.* Very few tutees need only scholarly assistance. If your tutoring sessions just solve homework problems, then your job is only partially done.

SHIFT ROLES. During a single tutoring session, you might work as a number of different people: tutor, teacher, counselor/friend, coach, and reference person. The goals and techniques are quite different for each of these. A tutor aids the tutee by drawing out the tutee's basic knowledge, and by clarifying points that the tutee has learned in class. A teacher supplies new information. A counselor/friend helps with problems not directly related to the class. A coach helps with learning skills and gives pre-exam pep talks. A reference person answers specific questions to which the tutee has already tried to find an answer. These roles should be separated from one another. Note that tutors and teachers have opposite functions. A teacher gives information, but a tutor helps the tutee to bring out that information and to use it.

ENJOY THE SESSIONS. Pleasure increases learning. Smile and be personal. This fights math/science anxiety. Let the tutee know "How I did it . . ." Remember, math is merry, physics is fun, and so on. . . .

RELATE WORDS TO SYMBOLS. is (=), by (x), difference (-), ratio (÷), sum (+), total (+), twice as great (x2), etc.

PRACTICE WITH ESTIMATION. Give the tutee exercises with estimating the answers and guessing in order to get a *feel* or reality: A book dropped from a table goes how fast?

USE HANDS, OBJECTS, AND PICTURES WHEN EXPLAINING. Science describes the physical world, so use everything around you to make concepts clear.

SET REALISTIC GOALS. Short-term goals that can easily be achieved increase confidence and decrease math anxiety.

LOOK OUT FOR MATH ANXIETY. Is the tutee terrified by the subject? If so, something must be done. Stress confidence and success.

CONSTRUCT FLASHCARDS. These are useful for memorizing. And the process of making them helps a student to organize material.

TELL JOKES. Make the sessions fun, not ponderous.

GO BACK TO BASICS. Problems are often caused by a poor math/science foundation. Review the basics when needed.

REPHRASE QUESTIONS AND INFORMATION. The tutee's math/science foundation might already be strong. Try using other words, not simpler ideas. Speak like a human, not a textbook.

CUT THE MATERIAL INTO BITE-SIZED PIECES. If the tutee is overwhelmed, focus on sections in which he/she will be a success. Divide the information into blocks that are less intimidating.

PROVIDE AN OVERVIEW. If the tutee is overwhelmed with the details, take time to put the pieces into

[1] This material was developed by Phil Deutche while working with the Educational Opportunities Program (EOP) at California State University, Northridge.

place. Discuss the overall scheme of the material.

PLACE THE PAPER IN FRONT OF THE STUDENT. The tutor should do very little writing. Everyone learns best by doing. If you're right handed, it is easiest to sit on the left side.

GIVE PROOFREADING PRACTICE. Have the tutee look for mistakes. Proofreading is even more important in math/science than it is in English. You might give hints, "I think there's something wrong on this line."

ENCOURAGE, ENCOURAGE, ENCOURAGE. Everything you do and everything you say should provide realistic encouragement. Tutees must attack problems with the notion: "I can do it." Problem solving then becomes a matter of looking for the clues of how to do it, rather than looking for the proof that it's difficult.

LET THE TUTEE HAVE TIME TO THINK. When you ask a question, give the tutee a chance to chew on it. It may seem like a long time if you know the answer, but the time goes very fast if you are trying to figure it out.

COMPARE LEARNING MATH/SCIENCE WITH TRYING TO LEARN A FOREIGN LANGUAGE. One must learn the alphabet, vocabulary, and grammatical rules. It is difficult and slow at first, but as one begins to think in the language and gains fluency, it becomes easy.

SCAN PROBLEM LISTS. Instead of working problems one by one, go briefly over an entire set of problems. Let the tutee give just the basic principle or formula involved. This is good practice in recognizing types of problems. The tutee gets confidence in knowing where to start.

TAKE EXAMPLES FROM DAILY EXPERIENCE. Resonance of a spring is a car bouncing over a bump. Thermal heat expansion is telephone wires sagging when it is hot. Concepts that are real are easier to learn than those that are theoretical.

DRAW ON THE TUTEE'S KNOWLEDGE AND RESOURCES. The tutee already knows or has access (in notes and textbooks) to most of the information. Try tutoring as though it was a topic you have never seen before.

MOVE SLOWLY THROUGH LEVELS OF ABSTRACTION. Use specific stages when going from normal language to scientific talk, to abstract symbols, to formulas, to numbers, and back again. Make the system clear.

WRITE LISTS OF WORDS, FORMULAS, AND SYMBOLS. Don't let tutees slide with a "general idea" of what something means. Making a glossary list is an important study technique.

CHAPTER 10

Academic Advising

by G. F. Paskusz

University of Houston

INTRODUCTION

A neglected stepchild in many colleges of engineering, proper and careful academic advising can easily make the difference between the reasonable success and abject failure of a minority engineering support program (MEP). There are two independent reasons to support this premise. The first has to do with how the typical current engineering curriculum evolved. The second has to do with the poor preparation of many minority students for college engineering courses.

In the late '50s and early '60s, a student in engineering often needed close to 150 credit hours for graduation, while the typical non-engineering student could get a bachelor's degree with perhaps 124 credit hours. To bring the engineering curriculum back in line with the rest of the university, the total units required had to be reduced. In most places this was done by eliminating introductory courses. Courses such as engineering orientation, freshman design, analytical geometry, and engineering graphics were simply dropped; others such as physics and chemistry began to be taught with the assumption that an adequate background for them had been established in high school.

As a result of this curriculum modification, most of the relatively easy introductory first-semester courses are now gone. The typical first semester today includes calculus, chemistry, freshman English, physical education, and two or three other courses such as computer programming, graphics, and introduction to engineering. Not only is this program demanding, but it assumes strong backgrounds in mathematics, chemistry, and English. Unless properly advised, naive students, unaware of the trap, will often sign up for the first-semester courses listed in the catalog and will get into serious academic difficulties almost immediately.

Differences in academic standards between inner city and suburban high schools account for the insufficient preparation of many minority students. Academic courses such as trigonometry, graphics, and advanced science, which may be offered routinely in suburban schools, fail to attract enough students in many inner city schools and therefore may not be available. Also, because of the relatively lower aspirations of many inner city students, academic competition and challenge in inner city schools are often lacking. Thus class valedictorians and "straight A" students coming from inner city schools, proud of their achievements and sure of themselves, are often not equipped to cope with suddenly finding themselves in a fiercely competitive environment in which their competitors are much better prepared academically. If they are to have a chance for success, they must be properly advised.

PROVIDING ACADEMIC ADVISEMENT

In our introductory remarks, we stressed the need of incoming freshmen for academic advising. Academic advising is of course valuable at all levels, but because of its great importance at the freshman level, we will concentrate on that part of the effort. We will discuss what kind of information is needed for effective advising, possible sources for that information, and how to translate it into advising.

What Information Is Needed and How To Get It

The objective of all academic advising is to match the student's capabilities with the requirements of the curriculum. In other words, we want somehow to maximize chances that the student will make satisfactory progress toward his or her educational goal. So we need to know precisely what the curriculum requirements are and we need to evaluate the student's capabilities.

An advisor's knowledge about the curriculum should be considerably more extensive than the contents of the engineering catalog. For example, if the first physics course listed is a calculus-based course in mechanics, the advisor needs to be aware of other physics courses offered on campus with their respective prerequisites. The same holds true for chemistry and mathematics. In addition to courses which can be assigned in preparation for a "first" course, there may exist less intensive course sequences which can be substituted for a given course. (For example, in one engineering program we are familiar with a two-semester, 8-credit hour chemistry sequence which can be substituted for the one-semester, 4-credit hour course listed in the engineering catalog.)

This kind of information must necessarily come from technical sources, such as engineering faculty associated with or at least friendly toward the MEP.

In order to keep the information current, MEPs need to be informed of any changes in curricular content and of college policies and procedures. This can be achieved by having MEP staff represented on advising and curriculum committees or by at least making sure they are on the mailing list for information coming from those bodies.

Evaluating the student's current capabilities is a far more demanding problem. A high school transcript can provide some basic information such as SAT or ACT scores, various advanced placement test scores, GPA, what courses were taken, which areas the student showed strength or weakness in, and what the student's standing in the graduating class was. Some situations to watch for are:

1. *Low SAT or ACT scores together with high GPA and high standing in graduating class*—The student probably comes from a high school with low academic demand. He or she may be very capable but in all likelihood is poorly prepared, has reason to be proud and self-confident, and may be devastated by an adverse first semester. Use diagnostic tests to properly advise students into a challenging but manageable first-semester program.
2. *Low verbal SAT, high math SAT (or equivalent ACT) scores*—The student is probably a slow reader and may have low reading comprehension and/or weak vocabulary. Additional diagnostic testing is indicated to pinpoint the problem, which, if left unattended, could rapidly lead to failure because of inefficient use of study time.
3. *Acceptable SAT or ACT scores, declining performance in high school*—Although the student meets the admission requirements of your college, grades in high school dropped toward the end. A variety of reasons could account for that including (a) the high school environment may have lacked completely in challenge, therefore the student got bored and lost interest; (b) the student found more challenge than could be managed, found advanced courses too tough; (c) there was a mismatch between courses taken and the student's conscious or subconscious career interests; or (d) there were personal problems. You may be able to think of other reasons for the situation. Whatever the reasons, the student is most probably not prepared to tackle successfully the standard first semester. Further diagnostic and/or vocational interest testing would help to determine the source of the problem. A careful approach, possibly a light load during the first semester, should be considered.
4. *The student barely meets minimum requirements for admission, did not excel in high school*—Prognosis for this student is poor. Vocational interest testing may be indicated. If possible, the student should be advised into a program that would allow transfer to another major with minimum loss of credit.
5. *Good record but a minimum of academic courses*—This situation again can arise for a variety of reasons, and proper academic advising cannot take place without knowledge of the real reasons. These may include: (a) not enough demand for courses which as a result were not available; (b) the self-defeating premise that it is more important to qualify for college admission by taking snap courses which lead to a high GPA, rather than to try to prepare for college by taking tough courses which may lead to a lower GPA; or (c) lack of motivation on the part of the student. In the first two cases, the deficiencies left by an inadequate high school education must be removed before serious engineering study can be undertaken. In the last case, vocational interest counseling would probably be recommended.
6. *High SAT or ACT scores, outstanding high school performance*—The student may be inadequately challenged in the standard MEP first semester courses, especially those specifically designed for the MEP program. Care must be taken to challenge this student without creating an overload.
7. *The student does not meet regular admission standards but was admitted to the university, possibly also to engineering, under some special action program*—Most of these students will fall under categories 1, 2, or 5 above, and should be treated accordingly.

Students who fall into category 7, and in some of the others, could benefit greatly from the availability of special cognitive development courses. Where no courses of this type are available, the MEP may wish to start its own. NACME has information on a course of this type based on Feuerstein's method.[1] A special course based partly on Piaget's theory of cognitive development is being taught at the University of Houston. Two applicable textbooks are *Problems in Problem Solving* by M.F. Rubinstein and K. Pfeiffer, Prentice-Hall, 1980, and *Problem Solving and Comprehension* by A. Whimbey and J. Lockhead, Second Edition, The Franklin Institute Press, 1980. There is an abundant number of puzzle books such as *Gotcha* by Martin Gardner which can be used in conjunction with a course on cognitive development.

Diagnostic Testing

Information gleaned from the high school record, from entrance test scores, and from talking to the student generally is not sufficient for optimal academic

[1] Feuerstein, Reuven, *Instrumental Enrichment, An Intervention Program for Cognitive Modifiability*, University Park Press, Baltimore, Maryland, 1980.

advisement. In most cases, a set of properly designed diagnostic tests can be of invaluable help. Testing should take place in at least three vital areas: math preparation, reading efficiency, and problem solving ability.

The easiest of these to use, because of its wide availability, is the reading efficiency test. A standard test, such as the Nelson-Denny, available from Houghton Mifflin Company, will help determine the student's reading speed, reading comprehension, and vocabulary.

Weak reading skills can easily change the normally expected two hours of study time required, on average, for each class contact hour, to three, four, or even more. For a student carrying 16 credit hours, that would mean having to spend 64, 80, or even more hours per week on schoolwork rather than the expected 48. It is therefore of the utmost importance to remove this problem as quickly as possible. Fortunately, most campuses offer either a course on reading and study improvement or workshops in this area through the counseling and testing center. In the absence of either of these, the MEP would need to arrange for such workshops. Students who score acceptably in reading comprehension and vocabulary but have a low reading speed may solve their problem by enrolling in one of the widely available speed-reading courses.

In contrast to the reading test, the diagnostic math test generally should be tailor-made. There would be no point in giving yet another version of the SAT math test. What one needs at this point is information about where in the math sequence students need to start. Since the student's high school math background may not have provided adequate preparation for the first required math course, one needs to determine what preparatory math courses lead to calculus, and what the content of these courses is. A few test questions which are designed to probe the student's speaking acquaintance with the concepts and operations involved are usually sufficient to determine where the students should start.

One such test is used in the PROMES program at the University of Houston. (It is reproduced in the Appendix of this chapter.) The first fifteen questions cover basic math concepts and algebra, the next eight test the student's knowledge of geometry and trigonometry, and the last seven questions deal with material found in the pre-calculus course taught there. The answering and scoring sheet shows the scores needed on each of these sections to place out-of-college algebra, trigonometry, and pre-calculus, respectively. This test has been used successfully for more than eight years at the University of Houston. A statistical analysis of student performance, comparing those who took the diagnostic test and those who did not, showed not only significant but rather spectacular results; that is, better performance by the group who had taken the test. That group, incidentally, was more poorly prepared as judged by GPA and SAT scores.

The third area in which deficiencies are often discovered is cognitive development, which involves the student's ability to deal with abstractions and to solve problems. (A sample diagnostic test to determine the student's adequacy in this area may be found in the appendix to this chapter.) Students who perform poorly in this area need to be given the opportunity to improve their analytical thought processes. A course in problem solving, if available, may serve that purpose. If no such course exists, it may be necessary for the MEP to develop one.

Applying the Information

In the previous sections, we discussed what information is needed for good academic advising and how to get it. We also briefly suggested what actions may be appropriate depending on what was learned about the student's capabilities. In this section, we want to treat some of these possible actions in greater depth.

There would be no need for academic advising if there were no options in the curriculum. These options often are not spelled out in the university catalog and must be determined by the MEP staff. Once they are determined, the options can be displayed in a curriculum flow chart (for example, see the Appendix at the end of this chapter). The results of freshmen advising can then be recorded by simply circling the courses the student has been advised to enroll in. One advantage of such a chart is that it is easy to see immediately which courses will need to be taken the following semester and particularly which courses are most important as prerequisites for further study. The chart can thus be used for a student's long-range academic planning.

The student's background and preparation is the most important factor in deciding what specific courses a student should take. In addition, the choice may be limited by university and school of engineering regulations. If possible under university rules, the first semester's program should be light. It is relatively easy to find additional tasks for a student who turns out to have too light a course load. On the other hand, getting off to a bad start because one's preparation has been overestimated can be emotionally as well as academically disastrous. If advising is to err, it should err on the side of a light first-semester load.

Usually a first-semester program of between 12 and 14 semester hours is sufficient to keep a full-time freshman busy. For MEP students who have not participated in a summer bridge program, typical first-semester courses might include freshman engineering orientation, problem solving, mathematics, English (or reading and study skills), and physical education. For those who come from a bridge program in which orientation, problem solving, and reading and study skills courses were given, a typical first semester might consist of math, chemistry, English, physical education,

and a general education course such as history.

Prior to academic advising, MEP advisors need to know the reputations of the various instructors of freshman courses. This information should be used to assign students to good and sympathetic instructors. "Good and sympathetic" should not be confused with "easy." Easy instructors can be as counterproductive as weak high school preparation was. Students who have not mastered a course are far better off repeating it than they would be if allowed to attempt the next course while still lacking the prerequisite knowledge.

Since there usually is not an overabundance of good and sympathetic instructors for any given course, advising students to sign up for the ones who meet this description automatically clusters students in a few sections. This situation has definite advantages. Students who are in the same section can study together and support each other in other ways. The odd and lonely feeling of being the only minority student in a class of forty is also avoided.

All this planning can quickly come to naught if the student when registering finds the section closed. Therefore, some way must be found to ensure that MEP students can get into the proper sections. Mechanisms for achieving this will vary from one institution to another. Methods which have been found effective include: running MEP students through early or priority registration; reserving a number of spaces in specific sections and allowing the MEP advisors to assign those spaces; and placing MEP students in hidden sections (not listed in the schedule of classes). Whether it is desirable to schedule restricted sections for MEP students only should be given careful consideration since it leads to their being isolated academically.

Selecting Academic Advisors

The ideal academic advisor would be a person who has a thorough understanding of the freshman year math/science courses and who also has a good counseling background. Freshman advising is most often done by a campus counseling center, by MEP staff, or by faculty. The first of these, counseling center personnel, are usually well trained and competent in the area of interpersonal communication, but they may not be attuned to the engineering and pre-engineering curriculum or to the type of first-semester program needed by MEP students.

If freshman advising is to be done by engineering faculty, special steps should be taken to motivate and prepare them for this assignment since faculty frequently are under pressure to conduct research and publish. In such an environment, advising freshman students does not show up significantly in the faculty member's reward structure and therefore does not enjoy a high priority. A formal training program can help to improve the situation. The MEP at California State University, Northridge, has developed a model training program of this type which is discussed in Chapter 14.

MEP staff may be in the best position to provide good quality academic advising to freshman students. Certainly MEP staff would be expected to possess adequate communication skills and concern for the students. Over time, by working closely with engineering faculty and administrators, MEP staff can develop a high level of understanding of the curriculum, particularly that related to freshman level work in mathematics, science, and English.

Advisement for the Advanced Student

Continuing students should be advised by the MEP advisors, if possible, until they complete their regular freshman courses. This usually will take more than one year and will push the advising record close to the end of the curriculum flow chart. To keep students from being caught without some of their prerequisites, students should prepare a study plan to cover three semesters at a time. A simple form made up for this purpose would be completed in duplicate, with the student getting one copy and the MEP retaining the other.

Real problems are liable to arise once students leave the protective MEP environment and begin to depend on their departmental faculty for advising. As pointed out previously, advising is not the most rewarding activity for faculty, and an attitude of seeming permissiveness can actually be one of neglect.

It is important therefore that the advisor monitor the student's academic program to ensure that it is realistic and that it is moving the student ultimately toward graduation. Some students may wish to sign up for an unrealistically heavy courseload so that they can graduate in a preconceived time frame. This can result in the student's not graduating at all. At the other extreme some students may be obsessed with the idea of making good grades and select a course program which does not move them toward their degree objective.

Following Up on Advisement

Advisement enjoys its greatest usefulness if students actually end up taking the courses they are advised to take. We already discussed what actions can increase the probability that students will be able to actually enroll in the courses for which they are advised. It is equally important to find out if they stay in those courses and how they perform.

A good personal relationship with the staff of the office of the registrar should make it possible for the MEP to get copies of enrollment records for its students shortly after class rolls are compiled. To find out how students perform, the MEP could then mimic the athletic department and send requests for a short student progress report to all of its students' instructors. If you do this, don't forget to thank those instructors who respond.

On the other hand, if students are clustered into class sections, the instructors of those sections may be amenable to reporting on an ongoing basis if supplied

with forms which list students' names and provide space to report test scores and make comments.

CONCLUSION

In discussing academic advisement, we have naturally touched on other subjects treated in this Handbook. Chapter 2 should help put the advising activity in proper perspective as an integral component of a successful MEP. Orientation course design is treated in greater depth in Chapter 5, and Chapter 6 discusses student monitoring strategies in detail. Chapter 14 deals more extensively with the relationship between the engineering faculty and the MEP.

The overall objective of an effective academic advisement program is to ensure that MEP students are enrolled in an appropriate set of classes in terms of both total courseload and level of specific courses, that they have the best available teachers, and that they are clustered to the extent feasible in common sections to promote group study and mutual support. The importance of the academic advisement and registration process on the ultimate academic performance of MEP students cannot be overemphasized.

Appendix A

UNIVERSITY OF HOUSTON
CULLEN COLLEGE OF ENGINEERING
PROMES MATH PLACEMENT TEST
GFP, 7-78

Mark your answer sheet only. Do not write on the exam paper. Scratch paper will be supplied for your use.

1. $\frac{1/2 + 3/4}{1/2}$ =
(1) 5/2 (2) 7/4 (3) 3/4 (4) 1 3/8 (5) None of these

2. $\sqrt{4/9}$ =
(1) 4/3 (2) 2/9 (3) 2/3 (4) 16/81 (5) None of these

3. 2^3 =
(1) 6 (2) 16 (3) 4 (4) 5 (5) None of these

4. 32 + (-12) =
(1) 44 (2) 20 (3) -44 (4) -20 (5) None of these

5. 540/-30 =
(1) -18 (2) 18 (3) 510 (4) -510 (5) None of these

6. 10^0 =
(1) π (2) 0 (3) 1 (4) 10 (5) 0.1

7. 4^{-3} =
(1) -1/12 (2) 1/64 (3) -12 (4) 1/12 (5) None of these

8. $8^{\frac{2}{3}}$ =
(1) $(\sqrt[3]{8})^2$ (2) $(\sqrt[2]{8})^3$ (3) $8^2/8^3$ (4) $8^2 \times 8^{1/3}$ (5) None of these

9. a(b+c) =
(1) abc (2) ab + c (3) a + bc (4) b(a+c) (5) None of these

10. $\frac{a/b}{c/d}$ =
(1) ac/bd (2) ad/bc (3) bc/ad (4) bd/ac (5) None of these

11. $x^m x^n$ =
(1) x^{mn} (2) x^{m+n} (3) $2x^{mn}$ (4) $2x^{m+n/2}$ (5) None of these

12. The solution of the equation 3x + 4 = 0 is: X=
(1) 3/4 (2) -3/4 (3) 1.25 (4) -4/3 (5) None of these

13. Factor completely $3x^2 - 13x + 12$=
(1) (X-12) (X-1) (2) (3X-3) (X-4) (3) (3X-4) (X-3) (4) (3X-12) (X-1) (5) None of these

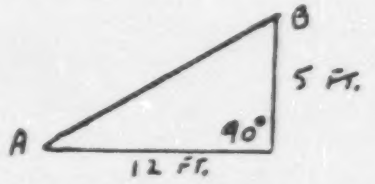
14. When the expression $1 - \frac{x + 1}{1 + \frac{1}{x}}$ is simplified, the result is
(1) $(3X - X^2 - 1)/X$ (2) $(-X^2 + X - 1)/X$ (3) 1 - X (4) X (5) 1

15. The solution of the pair of equations $3X + 7Y = 2$
$-2X + Y = -7$

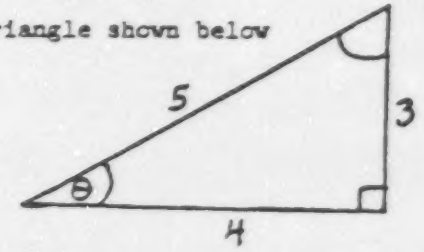
(1) (1,-3) (3) (-1,3)
(2) (-3,-1) (4) (3,-1)
(5) 0.1

16. The length of AB is

(1) 10 ft. (3) 13 ft. (5) None of these.
(2) $\sqrt{119}$ ft. (4) 17 ft.



The next three questions refer to the triangle shown below



17. It's area is:

(1) 6 (3) 20/3 (5) None of these.
(2) 12/5 (4) 15/4

18. Tan θ =

(1) 3/4 (3) 5/4 (5) None of these.
(2) 4/3 (4) 3/5

19. Sin θ =

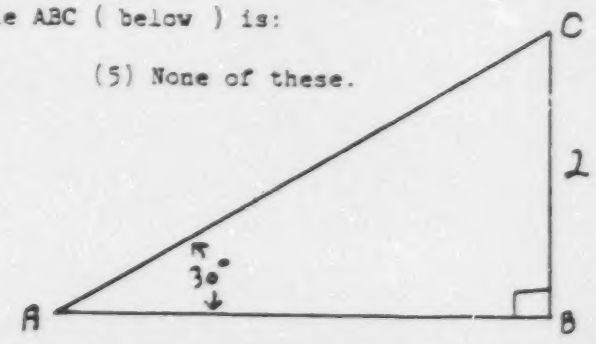
(1) 3/4 (3) 5/4 (5) None of these.
(2) 4/3 (4) 3/5

20. For an arbitrary angle θ

(1) $\sin\theta + \cos\theta = 1$ (3) $\sin^2\theta = 1 + \cos^2\theta$ (5) None of these
(2) $\sin\theta - \cos\theta = 1$ (4) $\sin^2\theta = 1 - \cos^2\theta$

21. The length of side AC of triangle ABC (below) is:

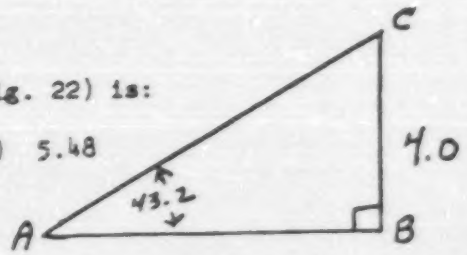
(1) $\sqrt{21}$ (3) 1 (5) None of these.
(2) 4 (4) 2.5



22. The length of side AC of triangle ABC (Fig. 22) is:

(1) 2.74 (3) 4.26 (5) 5.48
(2) 3.76 (4) 5.84

Cos 43.2° = .72897
Sin 43.2° = .68455
Tan 43.2° = .93906



(Fig. 22)

23. An angle which measures 300° has radian measure

(1) $5\pi/6$ (3) 5 (5) None of these.
(2) $5\pi/3$ (4) $11\pi/6$

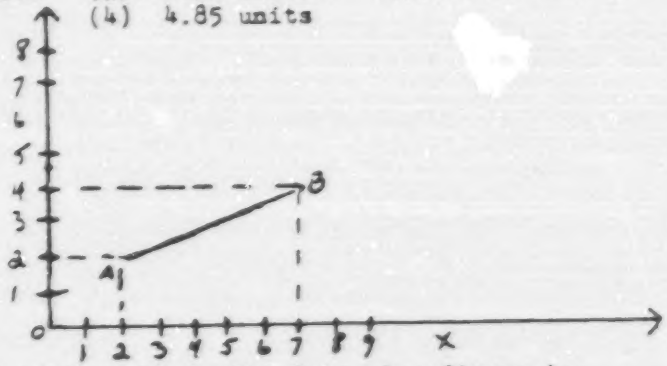
24. The simplified form of $\log (X^2-1)-\log(X+1)+\log 2$ is

(1) $2(X^2-1)(X+1)$ (3) $\log(2X-2)$ (5) None of these.

(2) $\log (X^2-X+2)$ (4) $\log(X^2-X)$

25. The length of line AB in the figure below is:

(1) 5.93 units (3) 4.58 units (5) 5.39 units
(6.21 units (4) 4.85 units



26. The equation of line AB in the foregoing figure is:

(1) $Y = 0.4X - 1.2$ (3) $Y = 0.4X + 1.2$ (5) $Y = -2.5X + 1.2$
(2) $Y = 2.5X - 3$ (4) $Y = 1.75X - 1$

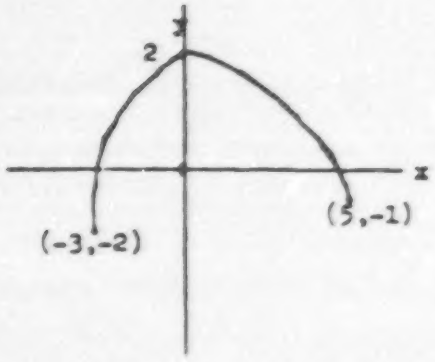
27. If $f(x) = 2X + 1$ then $\dfrac{f(x+h) - f(x)}{h} =$

(1) $2h + 1$ (3) $2X + h$ (5) None of these
(2) $2X + 2h + 1$ (4) 2

28. The graph of the quadratic function $f(x) = X^2 + 2X + 1$

(1) has a minimum at (-2, 1) (3) has a minimum at (-1,0)
(2) has a maximum at (-1,0) (4) has a maximum at (-2,1)
(5) None of these.

Let the graph below be the graph of f for question 29.



29. f(0) =

(1) -3 (3) -1 (5) None of these
(2) -2 (4) 2

30. Which of the foloving is an increasing function?

(1) f (x) = -2x - 5 (3) f (x) = -3 (5) None of these
(2) f (x) = 3 (4) f (x) = -5 + 2x

Questions 1-15 pertain to lower math including algebra. Students who fail more than 4 questions are assigned to college algebra.

Questions 16-23 are on geometry and trigonometry. Students who miss more than 3 questions are assigned to trigonometry.

Questions 24-30 are on pre-calculus. Students who miss more than 3 questions are assigned to pre-calculus.

In borderline cases students are encouraged to review the troublesome area and to retake the test before the beginning of classes. We supply these students with "Concise Review of Algebra and Trigonometry" by A. W. Goodman, now out of print, but reprinted by us with the permission of the author; or, respectively, "Technical Calculus with Analytic Geometry", 2nd edition, by A. J. Washington, Benjamin/Cummings Publishing Co., 1980.

Name_____ Date_____

Algebra Word Problems
Rev. Jan 82, gfp

1. Write an equation using the variables S and P to represent the following statement: "There are six times as many students as professors at this university." Use S for the number of students and P for the number of professors.

2. Write an equation using the letters S and W to summarize the data below.

Stretch S(cm)	Weight W(g)
3	100
6	200
9	300
12	400

3. A can do a certain job in 3 days. The same job takes B 6 days to do. If they work together, how long before the job is done?

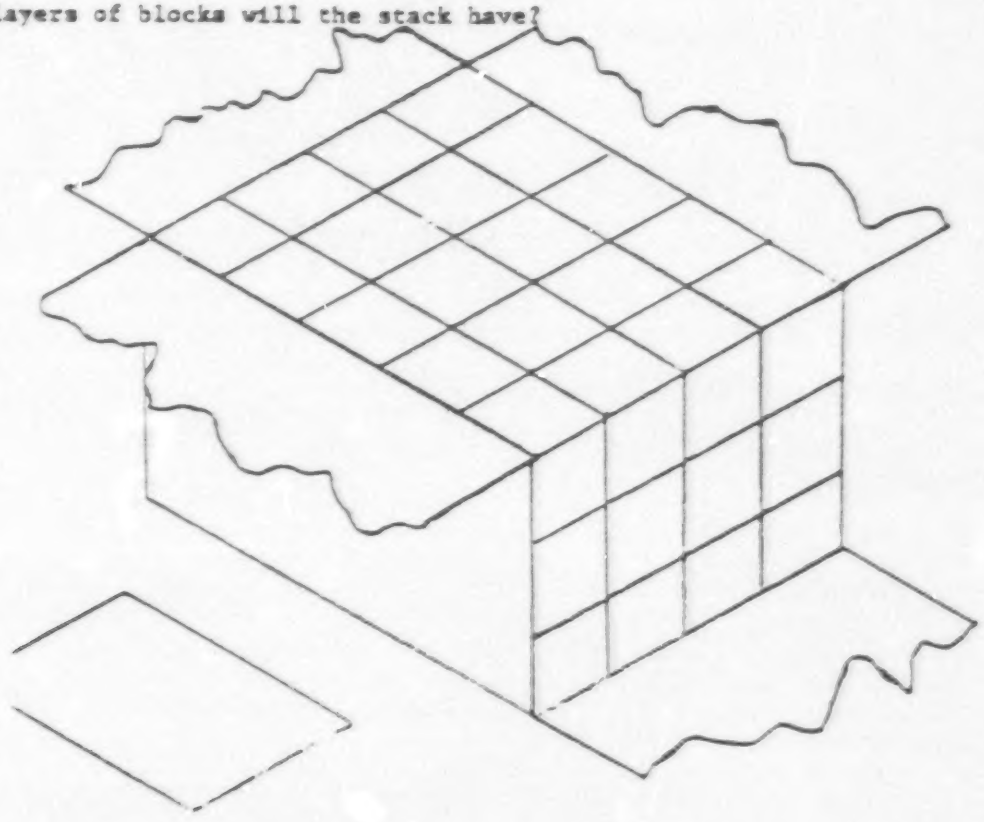
4. The sum of two numbers is 24 and one is twice the other. Find the numbers.

UNIVERSITY OF HOUSTON
Program for Minority Engineering Students

BUDDY'S BUILDING BLOCKS

Buddy is nine years old now, but his favorite toy is still the set of building blocks that his Dad gave him for Christmas years ago. Now, the original box that held the blocks is ragged and can no longer be used as a storage place for the blocks.

Of course, Buddy's mother insists that the blocks be stored away neatly and she has even assigned him a space in the closet. The shelf space is not as big as the old box was, but Buddy's mother insists the blocks will be stacked there -- it'll just be a taller stack. So how many layers of blocks will the stack have?

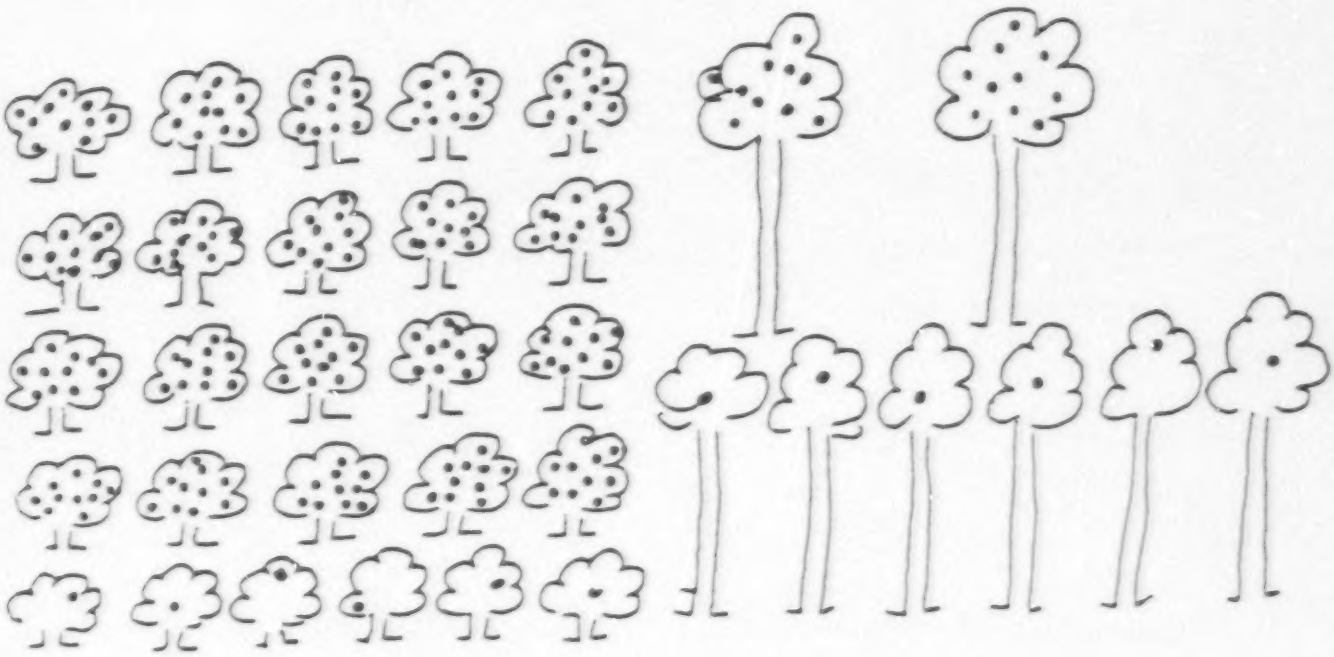


GFP:10/28/83

UNIVERSITY OF HOUSTON
Cullen College of Engineering
PROMES

The Apple Tree Problem

A farmer bought an old abandoned apple orchard. He noticed that in one part of the orchard the apple trees were stout and low to the ground and in another part of the orchard they were tall. Also, some of the trees had lots of apples on them and some hardly any. Here is what a part of the orchard looked like:



1. Is there a relation between the size of the tree and whether it bears few or many apples? (circle the answer)

   yes no

   Explain your answer:

2. Suppose the farmer states that his stout trees bear many apples.

   a. What arguments can you give to support that statement?

   b. What arguments can you give against it?

gfp:3/14/83

UNIVERSITY OF HOUSTON
Program for Minority Engineering Students

MARVIN'S MARBLES

One day while walking down the street, little Marvin Mayson stops outside the toy store window. On display is a huge jar of marbles with a sign that reads: "TAKE A GUESS AT THE NUMBER OF MARBLES IN THIS JAR. CLOSEST GUESS WINS ALL THE MARBLES!"

Well, Marvin can't take his eyes off the treasure of deluxe cat's-eyes. He is carrying his personal collection of 57 butterfly spinners and wracks his brain to come up with a plan to win this bonanza of cat's-eyes. "Sometimes", Marvin whispers to himself, "the way to win something wonderful is to take a chance with what you already have."

Poker-faced but eyes twinkling, he sidles up to the manager and volunteers to add his butterfly spinners to the jar, to create an even better prize. The manager gladly accepts the offer and dumps Marvin's marbles into the jar.

Marvin suggests, "Don't you think we should mix them up to make a prettier display?"

"You some kind of Madison Avenue marketing expert?" the manager growls, but he mixes the marbles so that Marvin's butterfly spinners are evenly distributed throughout the jar.

Marvin wanders about the toy store until his big chance comes while the manager is busy with a paying customer. The boy scoops two handfuls of marbles from the jar, spreads them on the counter and counts a total of 63 marbles, nine of which are his beloved butterfly spinners. And now all the marbles will belong to Marvin, unless you can tell the manager first how many marbles are in the jar.

CFP:10/28/83

Appendix C

UNIVERSITY OF HOUSTON

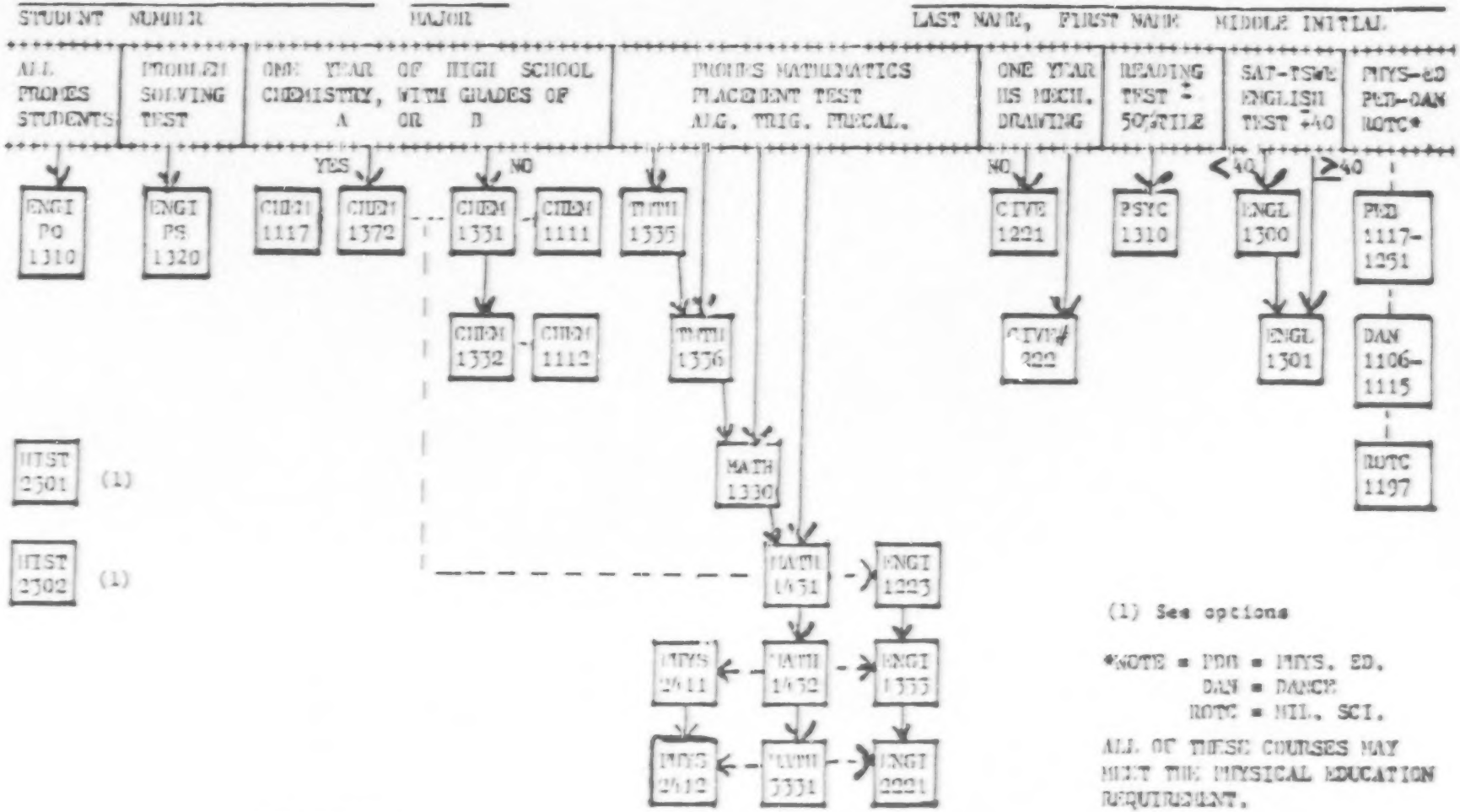
PHOMES

PROGRAM FOR MINORITY ENGINEERING STUDENTS

DATE _____

COURSE FLOW CHART

STUDENT NUMBER _____ MAJOR _____ LAST NAME, FIRST NAME MIDDLE INITIAL _____



(1) See options

*NOTE = PED = PHYS. ED.
DAN = DANCE
ROTC = MIL. SCI.

ALL OF THESE COURSES MAY MEET THE PHYSICAL EDUCATION REQUIREMENT.

#NOTE = FOR CE MAJORS ONLY

——— PREREQUISITE

- - - - CREDIT FOR OR REGISTRATION IN

GPT/USM/ION
REV/08-80

CHAPTER 11

Personal and Career Counseling

by Ron Simmons and Cassandra Maxwell-Simmons

Cornell University

INTRODUCTION

Counseling, one of the most important areas in higher education, is particularly important to minority engineering programs (MEPs). Although no major studies have isolated counseling as the sole indicator of a minority student's success or failure in college, we do know that the *least* likely cause of failure is lack of ability.[1] Other factors are more likely to impede the minority student's success, factors that are non-academic in nature but which bear heavily on a student's academic performance: financial concerns, family pressures, conflicts over the need to work versus the need to study, lack of motivation, feelings of isolation or alienation. The list goes on and on, but the point is clear. With the myriad of problems that minority students often face, it is incumbent upon MEPs to provide adequate and competent personal counseling services for their students.

But this demand is not easily met. For one, most MEPs have a high student/staff ratio. An MEP will typically enroll two hundred or more students, yet have only a modest staff. This alone makes it difficult, if not impossible, for an MEP to provide adequate counseling services. Added to this problem is the likelihood that MEP staff members are not trained counselors. While some people in higher education would argue that *anyone* can counsel students—all you need is a willing listener and a knowledgeable "dispenser" of information—this view of counseling is superficial and naive. Counseling, in fact, involves learned skills and techniques, especially in the area of cross-cultural counseling.

In light of the necessity for counseling in a minority engineering program and the problems MEPs are likely to face in developing a personal counseling program, this chapter will focus on three major areas. First, it will discuss resources which the MEP can utilize to provide comprehensive counseling services. Second, it will describe basic counseling techniques to guide and educate the lay counselor. Last, it will look at the kinds of problems and needs MEP students have and suggest ways in which the MEP can address them.

COUNSELING RESOURCES

To develop an effective personal counseling program, the MEP must first address the question of resources. As noted above, the enrollments alone in a typical MEP create the biggest problem, since the average MEP staff lacks the personnel to meet all of the counseling needs of its students. The MEP therefore needs to structure a program that taps other existing counseling sources, both in and outside the university. The campus counseling center, for example, can generally be helpful. With a staff of professionally trained counselors, the counseling center can provide critical advice and guidance in the development of an MEP counseling program, plus supply personnel to assist in actual counseling. The psychology department or educational psychology programs may also offer help. Faculty in these areas could be recruited to take part in the MEP counseling program, or student interns could be assigned to the MEP for their practicum. The career planning and placement office is yet another resource, particularly for providing career counseling, advice on securing jobs, and the like.

Closer to home, the school of engineering can be a valuable resource. As most engineering faculty are already familiar with MEP and many have had MEP students in their classes, they are in a good position to serve as advisors, counselors, and mentors to MEP students. And within the MEP itself, both students and graduates can be enlisted to participate in peer counseling.

Finally, industry presents a viable resource for MEP's counseling efforts. Professional engineers and computer scientists, particularly minorities, can offer a wealth of guidance and advice, since they have likely experienced the same kinds of problems the students have.

COUNSELOR TRAINING

All of these suggestions regarding counseling resources hinge on a critical qualifier: can the people identified effectively counsel minority students? This question, in turn, gives rise to other important considerations, such as:

- Are there certain factors unique to counseling ethnic minorities?
- What cultural differences among Blacks,

Hispanics, American Indians, and other minorities should counselors understand?

- Can white counselors be effective in helping minority students?

Let's look briefly at these issues as a preamble to the next area of discussion—counselor training.

The two salient points to stress here are that (1) there *are* factors unique to counseling ethnic minorities, and (2) white counselors generally *cannot* help minority students—unless they have a strong background in multicultural issues. According to Dr. Donald Cheek,[2] a noted psychologist, counselors of minority students must be able to make adjustments for cultural differences. But to do this, they need "an intimate knowledge of what is 'real' within a subculture and how that reality differs from what is true for the larger society." The problem with most counselors, white counselors especially, is that they apply culturally biased ideas and theories in their counseling of minority students, exhibiting little sensitivity to or interest in the non-white experience. Cheek appropriately calls such counselors "culturally deprived" because of their exposure to mostly white interpretations of history and the social sciences, learned from white teachers, in white schools, and in white communities. As a result, counselors often misinterpret or do not fully understand the problems of students and, rather than convey empathy and concern, appear patronizing and uncaring. Counselors, therefore, cannot take the position that all students are alike and should be treated alike. They must understand ethnic frames of reference and recognize individual differences. This is particularly important when counseling women MEP students, who have to contend with the "double bind" of being minority and female.

In developing a counseling program, the MEP will most likely need to provide some kind of intercultural training—at least for its "culturally deprived" counselors and perhaps for all its counselors. A program such as "FAMES" (see Chapter 14), which has successfully trained engineering faculty to be effective counselors, advisors, and mentors of ethnic students at California State University, Northridge, is an ideal vehicle to meet this need.

The MEP director will need to explore the resources available on the campus and utilize those that are most applicable or beneficial. It is possible, for instance, that the counseling center already offers an intercultural training program. If not, specialists from the counseling center, psychology department, ethnic studies departments, and other areas of the campus could guide the development of a program tailored specifically to the MEP's needs. Grants awarded to fund instructionally related activities could be sought to help underwrite the expenses for program development, or the institution might be persuaded to give selected faculty reduced teaching loads so that they could put the program together. In any event, the MEP director will have to be creative and imaginative in planning and offering such training.

Because, as mentioned above, the MEP staff and many of the people enlisted as counselors will not be professionally trained, there will exist a further need to provide basic counseling training. Counseling, we said, involves acquired skills and, while some people devote their entire education to the field, there are certain basic concepts that every counselor, lay as well as professional, should know.

A COUNSELING MODEL

Many theories and methods of counseling have been developed over the years. The one described here is a developmental counseling model similar to that advocated by Carkhuff[3] and Egan[4] which captures the essential details of all the others while presenting an easy, understandable approach. For the sake of this discussion, we must assume that a student who seeks counseling has a "problem," which can be anything from "I don't know what field of engineering to major in" to "I sometimes feel like killing myself." The "problem" is what brings the student to a counselor.

The developmental counseling model consists of four phases: (1) relationship, (2) exploration, (3) personalizing, and (4) action. The first phase, "relationship," creates a base for risk and learning. The objective of this phase is to establish a rapport between counselor and student and develop a bond of trust that will lead to an honest exploration of the problem. This is often the most difficult step for lay counselors, as their tendency is to jump to problem solving without spending enough time listening to the student, cultivating a rapport, and conveying attitudes of respect, sincerity, and concern.

Listening is a key requirement in establishing a relationship. As Philip Wankat[5] explains, a "good" listener is an "active" listener who refrains from judgmental comments, who expresses empathy, and who encourages the student to help himself. The active listener uses verbal as well as non-verbal cues to encourage the student to talk. He or she maintains eye contact, nods and gestures at appropriate times, saying "uh-huh" or "I see," and keeps an attentive body position that shows he or she is listening. Asking non-directed questions creates opportunities for the student to explore his problem. By restating or paraphrasing what the student has said rather than inject his or her own opinions, the counselor resists the urge to steer the conversation in a specific way. Above all, active listeners know how to be silent. They are comfortable with silence and do not feel compelled to fill the void with their remarks. Instead, they know that, in the temporary absence of conversation, the student is continuing to explore his problem, and the counselor waits for him to resume talking.

With the relationship established, the counseling proc-

ess moves into the second phase, "exploration." In this step, the counselor helps the student delve into his problem, ferreting "real" concerns as opposed to surface issues. A student's verbal message ("Which courses should I take?") and his emotional message ("I am confused, anxious, scared") may be quite different. By focusing on the student's feelings at the moment and by helping the student understand his current situation—"Where are you now?" versus "Where do you want to be?"—the counselor enables the student to learn something about himself.

In the third phase, "personalizing," the student more deeply explores his situation and tries to discover his role in the problem. That is, he tries to determine what he is doing—or not doing—that contributes most directly to his problem. Through careful listening, paraphrasing, and questioning, the counselor can aid the student in recognizing and accepting his role in the problem. Once that is accomplished, the student has laid the foundation for constructive action.

In the final phase of the counseling process, "action," the student decides what he must do to resolve the problem. While the counselor should work with the student to define an appropriate course of action, the counselor should be careful not to jump to conclusions or prescribe solutions hastily. It is better not to give advice but, instead, let the student solve his own problem. As Philip Wankat[5] warns, "Many students are overly anxious to take advice, but it does not help them become mature, independent people, capable of solving their own problems." So, in this last phase, the counselor again should play the role of questioner and prodder, helping the student develop possible solutions to his problem and select the best, most appropriate course of action to pursue.

The counseling process should not abruptly end at this point. Follow-up sessions should be scheduled so that the student can report on his progress—or failure—in overcoming the problem. In subsequent discussions, the student may discover that the action he has chosen does not really address the problem. Or he may find that the true nature of his problem is different from what he originally thought and a new course of action is needed. Whatever the outcome of these follow-up sessions, they can serve critical functions in the developmental counseling process, whether it be merely to reaffirm the trust, rapport, and relationship established between counselor and student or to return anew to the exploration, personalizing, or action phase.

AREAS OF COUNSELING

With an understanding of the counseling process, we can now turn to a discussion of the problems and needs that MEP students typically have. These concerns generally fall into three areas: (1) freshman counseling, aimed at orientation and adjustment; (2) counseling beyond the freshman year; and (3) career counseling, particularly for graduating seniors and students nearing graduation.

Freshman Counseling

The MEP student's freshman year is undoubtedly the most stressful year, especially for a student who comes from a predominantly minority high school and enters a predominantly white college or university. The newness of the student's situation can be frightening, restricting his or her ability to perform academically and giving rise to feelings of alienation and frustration. For many students, they feel out of place and unsupported. They may have moved away from home and be living apart from their family, friends, and community for the first time in their lives. They may be struggling to adjust to the university environment, where they are engaged in rigorous, demanding studies—confronted by an uncaring and perhaps hostile faculty, and perplexed by the so-called "hidden curriculum." They may need to make friends and develop a support network to help them overcome their feelings of loneliness and isolation. They may need to learn how to approach university study—developing good study habits, managing their time effectively, accepting responsibility, setting goals.

Because of the critical nature of the freshman year, most MEPs have special orientation programs, summer "bridge" experiences, and freshman-year transition activities to address these concerns. Personal counseling can complement these programs and activities, particularly through the use of "action" counseling. As its name implies, "action" counseling is an aggressive approach to counseling in which counselors do not wait passively for students to come to them with problems. The "action" counselor will study each freshman's application file to identify potential problems, such as low math scores on the college boards, special financial needs, or any other piece of information that sheds light on the student's situation. A freshman assessment questionnaire such as the one in the Appendix to Chapter 6 can provide useful insight into the student's background and attitudes. The counselor then calls the freshmen in for counseling, making sure they know about the services available through MEP and offering help if appropriate.

Action counseling at the freshman level takes up where the other MEP freshman programs leave off. The action counselor will, for example, make sure that the students know about and can cope with the university's "hidden curriculum." Although the students may have been told repeatedly about campus policies, procedures, and deadlines, they may have forgotten or never clearly understood them. The action counselor will also be sure that the freshmen are familiar with vital campus services—the learning resource center, counseling center, library, student health center, etc.—and know how to utilize them.

When appropriate, the freshman counselor will

organize the students into formal study groups, special interest support groups (i.e., a women's support group), or "buddy system" support groups, in which four or five students use peer counseling and an informal buddy system to help one another solve problems and become adjusted to the university environment. To further cultivate a sense of community, the counselor might help arrange for the students to share dormitory rooms, or work with the students' academic advisors to cluster the freshmen in common sections of their required courses.

Working with the students individually and in groups, the counselor will help the freshmen develop their mechanisms for coping, build their self-image, and enable them to assess their own behavior. Exercises can help, such as having the students write a self-contract each month resolving to change a certain behavior, even in minimal ways: "I will not put off my next English assignment until the last minute" or "I will invite Alice to study with me." Target modeling—identifying a behavior that needs to be changed, then practicing the new behavior—can also be helpful.

Finally, monthly "town meetings" are a good way to reach the freshmen. The purpose of the meetings is to give the students a forum for complaining, venting frustrations, asking questions, or sharing accomplishments. Common problems such as financial aid, housing, and study habits typically will crop up, and, by answering questions and conducting discussions, the counselor will help solve the problems for a number of students. The town meetings also give the students the chance to engage in peer counseling—helping each other solve problems.

Counseling Beyond the Freshman Year

Freshman-year counseling is primarily aimed at giving the students a firm footing for their educational pursuits. But other personal problems, both during and beyond the freshman year, can interfere with the students' academic performance. Illness in the family, deaths, pregnancies, squabbles with friends or roommates, communication problems, low self-esteem, and lack of motivation are among the problems that students may have. In these cases, it is essential for the counselor to listen and help the student weigh options, find alternatives, and utilize other services available for medical, psychological, or career counseling. Get the student to think about alternatives rather than merely telling the student what to do: "What would you do if...?" or "Have you thought about...?" Take the student through the developmental counseling process. Once the problem is pinpointed, solutions can be worked out. Is the observable or articulated problem caused by something else? For example, does the student who complains about the social life really make an effort to contribute? Talking, but mostly listening, will help students solve their problems.

Action counseling can also be useful beyond the freshman year. Don't wait for problems to present themselves; seek them out. Monitor the students' progress in their courses; talk to their professors; confer with other counselors. Stop by the MEP study center to visit informally with the students or sit in periodically on their study/support group meetings. Encourage the students to continue attending the monthly town meetings after their freshman year, both to serve as peer counselors and to help work out their own problems. Since it is possible that other students are having difficulty with the same problems, they can be resolved jointly in the town meetings.

A particularly delicate problem that occasionally occurs, mostly after the freshman year, is the need to counsel students out of engineering. After what may be years of "hype" and extensive hard-selling to motivate and commit the students to engineering, some students simply will not be suited—either because of lack of ability or disposition. In these situations, it is essential for the counselor to maintain sensitivity, remain calm, and avoid confrontation. As this may be an emotionally-charged issue, the counselor should be careful not to challenge or threaten the student but rather look for positive traits to build confidence. When counseling a student out of engineering because he or she lacks the ability to succeed, the counselor should remember to base any assessments on facts (test scores, course grades, GPA, etc.) and avoid being judgmental. Offering as much assistance as possible, the counselor nevertheless should leave the ultimate decision up to the student. He should explore alternatives with the student, be available for future counseling, but know his limitations as a counselor and refer the student to other professionals when necessary.

Career Counseling

As MEP students near graduation, a variety of options present themselves. Should the student seek full-time employment? Should he pursue an advanced degree? Should he attempt to combine full-time work and graduate study? With these and many other questions pressing, the students will have new and different counseling needs that the MEP counselor should be prepared to meet.

For students who think they want to engage in full-time graduate study, they need to determine their field of study—engineering, business, law, medicine, etc.; the kind of degree they want—M.S., Ph.D.; and the institution they want to attend. Most will need to consider ways to finance graduate school and should carefully weigh the tradeoffs between full-time study and work.

Those who opt for full-time work likewise face a number of decisions. Should they seek work in private industry or the public sector? What type of work—sales, design, testing, research, development,

management—are they interested in? What personal considerations—location, salary, benefits, career opportunities—are most likely to affect their decisions about work?

The counselor should be able to offer guidance and provide information to assist the students in making these critical decisions. Many of the questions raised above can be answered through the developmental counseling process—that is, the student decides for himself through exploring and personalizing the direction his career should take. In some instances, however, the counselor will function more as a resource person for the student, providing information or referring the student to others for additional assistance.

Almost all students nearing graduation will need help in job hunting. Writing a resume, preparing for an interview, identifying opportunities, utilizing the campus placement office—these and other skills are crucial in the process of landing a job, and the MEP counselor should be ready to provide help or make referrals to aid the student in developing these skills.

Counseling for career advancement and success is another component of career counseling with which the MEP counselor should be familiar. There is the immediate challenge of managing one's career: growing professionally, getting experience, gaining visibility and exposure, networking, mentoring, setting goals. There is the longer-term need for personal development: improving written and oral communication skills; developing leadership, initiative, and decision-making skills; becoming involved in professional societies and in the community. And there are the ongoing demands of financial management: budgeting, financial planning, investing. While MEP counselors cannot be expected to have the expertise to assist students on all these levels, they should at least be in a position to refer the students to other professionals as needs dictate.

CONCLUSION

In summary, personal counseling is perhaps the most underrated aspect of a retention program for minority engineering students. If the MEP director is creative in tapping campus resources, diligent in providing counselor training, and sensitive to the many needs of MEP students, the personal counseling program will be a positive force in retaining students at the university and sending them out into the world prepared to succeed.

REFERENCES

1. Ray Landis, Enrique Ainsworth, Don Dorsey, and Mercilee Jenkins, "Training Faculty to Be Effective Advisors, Mentors, and Counselors of Ethnic Students: Dissemination Document for Faculty Advisors of Minority Students (FAMES) Program," California State University, Northridge, 1984, p. 1.
2. Donald Cheek, *Assertive Black, Puzzled White*, Impact Publishers, San Luis Obispo, CA, 1976, p.27.
3. Robert Carkhuff, *et al.*, *The Skills of Helping: An Introduction to Counseling*, Human Resource Development Press, Amherst, Mass., 1981.
4. Gerard Egan, *The Skilled Helper: A Model for Systematic Helping and Interpersonal Relating*, Brooks-Cole, Monterey, CA, 1982.
5. Philip Wankat, "The Professor As Counselor," *Engineering Education*, November, 1980, p. 154.

CHAPTER 12

Financial Aid

by Esteban Soriano

University of California, Berkeley

INTRODUCTION

One of the most critically needed support services for minority engineering students is financial aid. In any academic year, some sixty percent of all students who attend college in the United States receive some formal financial assistance. Adequate financial aid can play a major positive role in a student's completing an engineering degree. Conversely, when students receive bad financial aid advice or an inappropriate financial aid package, the results can be equally dramatic, particularly for underrepresented ethnic students. The aggregate data from numerous attrition and retention studies indicate that thirty percent of all drop-outs list inadequate financial aid as a primary reason for their dropping out and, most important, that for minority students, adequate financial aid is often the crucial determinant for academic success.

The process of applying for and obtaining financial aid is complex. It can confuse those professionals who are engaged in advising students, as well as the students themselves. Although the staff of minority engineering programs (MEPs) cannot expect to understand all aspects of the financial aid process, it is important that they be prepared to provide advice and assistance to students in certain key areas such as application deadlines, scholarship sources, and academic progress required to remain on financial aid.

The purpose of this chapter is to introduce the subject concisely; that is, the sources and types of financial aid available. In addition, the conditions and limitations of different types of aid will be discussed. Some reference guides that offer more detailed descriptions of qualifications, deadlines, and other procedures to be followed are noted. However, because the financial aid process varies somewhat from one institution to the next, MEP staff will need to seek out specific information regarding their individual situation.

FINANCIAL AID FACTORS

Most of the financial aid that students can obtain is based on the formula:

Demonstrated financial need = Cost of attendance − Resources the student (and family) can contribute

Each of the elements in this equation is carefully evaluated, and the amount of financial need demonstrated determines the award a student can receive, often in a combination or package from more than one source.

Cost of Attendance

Two main items comprise the amount taken into consideration as the cost of attending an institution—direct educational expenses and living expenses. The first, direct educational expenses, includes tuition, fees, materials charges, books, and supplies. These expenses will vary from one institution to another, and within institutions they can vary from one major to another. It may be possible for MEP staff to lobby for an increase in educational expenses for its students based on the fact that engineering majors are required to purchase drafting equipment, calculators, computers, and other materials not required of students in other majors.

The second item, living expenses, includes housing, food, travel, clothes, and other personal items. This amount will vary according to each student's personal situation. For example, a married student, particularly one who has children, will have higher living expenses than a single adult.

The student's housing arrangements also affect living expenses. Continuing to live at home with parents is considered to be less costly than living in a dormitory; living independently in an apartment is viewed as the most costly kind of student housing. For the purpose of determining financial aid, the student is usually free to choose among these options.

Contributed Resources

Financial aid officers refer to the resources that students and their families are deemed capable of contributing as "self-help." Self-help is defined as the amount the family can contribute to the student's education together with the amount the student should be able to contribute. This total will be determined based on the information the student provides on the financial aid application forms.

Although it is difficult to arrive at an equitable rule of thumb for parental contributions, given the different expenses and obligations of individual families, financial aid officers now follow a formula that computes this amount based on such variables as family income, other assets, the number of children in the family, and the

number of children attending college. The application form will ask for a breakdown of annual income and expenditures in these and other areas.

In addition to the parental contribution, the student is expected to contribute to his or her education from either previous savings or summer employment. The amount varies both from one institution to the next and with the student's year in school but typically is in the range of $700 to $900 per year. Some institutions permit the use of external scholarships or grants awarded to the student to cover the student contribution, but this is not common. Generally, externally generated scholarships will merely replace part of the student's financial package, thereby resulting in no increase in the total award. MEP staff are in a position to work with the financial aid office to see that external scholarships are incorporated into the financial aid package in a way most beneficial to the student.

Once the level of contribution from self-help has been determined, it remains the same regardless of the student's choice of college and living accommodations. Thus, if a student opts to go to a university with high tuition costs, any tuition increases will result in a larger demonstrated need, rather than a larger self-help figure. Conversely, if a student attends a less expensive institution, the reduced college costs will result in a reduced level of demonstrated need, but the expected contribution of the student and the family remains constant.

Demonstrated Need

In essence, then, financial aid is determined on the basis of the difference between the amount figured as the cost of attending a college and the amount the student and the student's family can supply. The final estimate is what is necessary to cover the student's expenses—that is, the demonstrated need. Demonstrated need can vary considerably, as shown above, mainly due to tuition costs.

MEP staff should encourage a student to apply to a number of appropriate institutions, without regard for costs, because institutions with high tuition often offer large amounts of financial assistance in order to accommodate the increased demonstrated need. Students may want reassurance that it is the demonstrated need that will be greater at private colleges, not the level of their contribution and that of their parents.

On the other hand, MEP staff should be prepared to clarify a student's potential misunderstanding about different amounts of financial aid that may be offered by different colleges. A larger award from an institution with high tuition will not mean more spending money for the student. It will only provide funds to be used directly for tuition, not for any personal expenses.

With proper counseling, a student can weigh decisions among institutions. The student can choose to attend the college or university, public or private, that has the most suitable program from those that offer comparable amounts of actual financial aid.

APPLYING FOR FINANCIAL AID

Financial aid is never automatic. Students must apply for aid and they must apply on time. These two important preconditions cannot be stressed too strongly. Too many students miss out because they fail even to initiate the process: they mistakenly assume that if they are unable to pay for their college program, somehow someone will find out and give them unsolicited financial assistance. Others fail to realize that deadlines are inflexible. MEP staff must ensure that there are as few of these students as possible.

Financial Aid Forms

The information a student submits on the various financial aid forms will establish the amount of aid offered. Typically, a student will have to fill out up to three different kinds of financial aid forms.

First of all, each campus to which a student is applying for admission will have an application form for financial assistance. This form is always different and separate from the application form for admission. A student who is applying for admission to a particular college and wants also to apply for financial aid must be sure to fill out that campus' own application for financial assistance.

In nearly every instance, students applying to one or more universities will also have to fill out a "Financial Aid Form" (FAF) and submit it either to the College Scholarship Service (the College Board) or the American College Testing Services (ACT). This form requires a fee. Nearly all university financial aid offices rely on the College Board or ACT to gather, process, and analyze a student's financial circumstances. The evaluation of the Financial Aid Form by one of these services will determine the amount of a student's self-help. For students applying from California, the process differs slightly. In California only, a student will fill out the "SAAC" form (a modified Financial Aid Form) and submit it to the College Board. Both the FAF and the SAAC make the student eligible for all appropriate federal and local campus financial assistance programs.

Some twenty-four states also offer state-initiated financial assistance programs. For these states there is a third financial aid form that enables a student to apply directly to that state for assistance. Here again, California is the exception. In California only, students can apply for state aid by filling out a supplementary form and submitting it with the SAAC application.

Thus, the three forms that a student might be required to complete in order to apply for all available financial aid are:

1. The application for financial assistance for each

university to which a student applies
2. The Financial Aid Form (FAF) submitted to the College Board or to ACT; again, California requires the SAAC form
3. The state assistance application form, which has a specific name in each of the twenty-four states that offer their own programs

An important point to remember is that each form has its own filing deadline. While the deadlines occur at the same time in general each year, the date may change from year to year. Each form will note repeatedly the deadline for submitting it. Campus applications for financial assistance will usually be available in November of the academic year prior to the one for which the student is applying. For example, if a student is applying to a particular college for fall 1986 admission, the financial aid application for that campus should be submitted as soon as possible; that is, by November 1985. While many institutions will accept financial aid applications from November through May or June, most will have what is called a "priority filing date," which is usually February 1st or March 1st. A student who files earlier will receive a more complete analysis of the financial aid application, which can result in a larger award.

The Financial Aid Form (FAF) usually is available in January and should be filled out and submitted as soon after that as possible in the year before the student will attend college. For those states that have assistance programs, separate forms must be filled out and submitted, usually during January and the first two weeks of February.

MEP staff should make very clear to students that once having obtained financial aid, they must reapply each year. Students must be advised that most financial aid is granted on a one-year basis, and the forms must be submitted again for each year that they are enrolled in order to continue receiving funds. For MEP students who do not maintain their eligibility by reapplying for aid, the loss of aid can be disastrous to their educational goals.

TYPES OF FINANCIAL AID

Financial aid as a term encompasses the various types of financial assistance available. In most cases, a student will be offered what is referred to as a financial aid package: a combination of the types of financial assistance for which the student is eligible. The basic types of financial assistance are:

1. grants
2. scholarships
3. loans
4. work study/assistantships

Grants are funds that a student does not have to pay back; a grant is a gift of money that is usually awarded on the basis of demonstrated financial need. Some grants are based on need plus other factors, such as intended major, background, or degree of underrepresentation.

Scholarships, also do not have to be repaid. While some scholarships are based on need, many are based on academic performance, community and organizational affiliations, intended major, or other criteria.

Academic loans, like any loan, must be repaid. Typically, loans offered as part of a financial aid package carry low interest, and repayment does not begin until six months after a student has concluded a college program.

Work study is a generic term that signifies financial aid in the form of payment for hours worked on campus. An offer of aid through work study usually sets a maximum amount that a student can earn. The actual amount, however, is the payment the student receives for the number of hours the student works. Unless the student works, there is no money received. Generally, it is up to the student to find his or her own work study job. There may be a work study office to provide assistance. However, work study jobs are generally abundant since the employer pays only a fraction (usually twenty percent) of the salary with the rest being paid by the work study grant. Assistantships are similar to work study, in that a student is offered a specific job and the financial aid is the amount earned from that job.

While much of the application process is subject to formulas and inflexible deadlines, financial aid packages can to some extent be negotiated. MEP staff can work with students who have been offered unsatisfactory financial aid packages. Staff members should be prepared to discuss with each student, and in some instances the student's family, the financial aid award. Most students eligible for an MEP program and for financial aid will receive a package consisting of grants, loans, and work study. For some students, the bulk of the package will be made up either of loans or of work study. Because of potential problems such packages can create, MEP staff should first advise the student and then perhaps assist the student in trying to obtain a more advantageous package.

The student and the student's family need to appreciate fully the ramifications of accepting a large loan which the student will be obligated to repay while just setting out on a career. Similarly, the difficulty for the student of undertaking a substantial work study load must be clear: that the student will have to balance time for work against time for study. Different students will respond differently to these pressures.

After informing and counseling the student, the MEP staff member can arrange a meeting with the director of the campus financial aid office. Sometimes packages can be altered to shift the proportion of loans or work study more toward the student's preference. On occasion, additional grant money may turn up or a new

scholarship. In any event, an articulate, informed discussion with the financial aid office can end in a reshaped package that is more satisfactory to the student.

SOURCES OF FINANCIAL AID

For the typical student, there are three main sources that generate or fund financial aid programs. They are: (1) the federal and state governments, (2) individual campuses, and (3) private organizations.

Government Programs

The federally funded programs for which MEP students may be eligible include:

1. Pell grant (PELL)
2. Supplementary Educational Opportunity Grant (SEOG)
3. College Work Study (CWS)
4. Guaranteed Student Loan (GSL)
5. National Direct Student Loan (NDSL)

On the state level, financial aid may come from:

1. State Student Incentive Grants (SSIG)
2. Loan programs
3. Fee waivers
4. State work study programs

Many MEP students will probably meet the eligibility criteria for the Pell grant: to be an undergraduate, enrolled at least half-time in an approved institution, and to fulfull a citizenship requirement. This grant, ranging from $900 to $1800 on the average, depending on the cost of attendance, is usually the foundation of a financial aid package. An economically disadvantaged student from an underrepresented ethnic group will also probably be eligible for a SEOG grant of about $1000. However, it is important to be aware that policies and conditions for eligibility can change from year to year for any of these federal and state programs, as well as for those listed below.

When students submit the Financial Aid Form (FAF), they declare if they want to be considered for all of the available federal and many of the available state programs. Thus, separate applications are not usually necessary, except as indicated earlier for those states that do require a special application.

Campus Financial Aid

The package a particular institution offers a student may include funds from campus financial aid programs. These programs can be of several types:

1. Campus-based loans (frequently short-term or emergency funding)
2. Tuition and/or fee waivers
3. Campus scholarships

Usually, the campus financial aid office will consider the student for these sources during the evaluation of the student's financial assistance application and FAF analysis.

Private Sources

A number of agencies, civic groups, companies, and organizations offer financial aid to students who meet specific criteria. Where this aid is administered by the campus, a student's application for financial aid will generate a review of each private aid program to determine eligibility. For those programs that make awards independent of campus financial aid offices, a student will have to identify each possible source and submit a separate application.

Additional Information on Sources

Although it is time-consuming to seek out independent, privately administered financial assistance, students should be urged to do so and to submit applications wherever there is a likelihood of meeting specific eligibility conditions. The student will, as noted, be considered for federal, state, and campus financial aid after filing the FAF and the application for financial assistance for each college. Nevertheless, the many private funding sources that are not covered by these applications are well worth pursuing, and a number of publications contain valuable up-to-date reference material for locating them.

Of particular interest to women and to underrepresented minority students are the following:

Financial Aid: A Partial List for Women, published by the Association of American Colleges

Selected List of Postsecondary Education Opportunities for Minorities and Women, published by the Federal Government

The Director of Scholarships, published by the Federal Government

Financial Aid for Minorities in Education, published by Garrett Park Press

These publications are too expensive for an individual to purchase but are in most campus libraries (or in the financial aid office). The reference desk librarian of any public or college library can usually give any further assistance that might be needed to identify current scholarship and financial aid compendiums.

Several organizations that focus on educational opportunities for specific ethnic minorities provide information about financial aid and in some cases their own scholarships. Among these sources are:

National Scholarship Service
and Fund for Negro Students
562 Third Street
Brooklyn, New York 11215

Office of Indian Education Programs
Bureau of Indian Affairs
18 and C Streets, N.W.
Washington, D.C. 20245

League of United Latin American Citizens
National Education Service Center
Suite 716, 400 First Street, N.W.
Washington, D.C. 20001

It should be noted that there are many other sources of information that can easily be collected. The College Board and ACT publish literally scores of pamphlets, booklets, and books on the subject of financial aid. There are publications that describe financial aid to students, parents, education professionals, and lay persons. Each organization will provide multiple copies of documents. Contact:

The College Board
College Scholarship Service
888 Seventh Avenue
New York, N.Y. 10102

American College Testing Program
Iowa City, Iowa 52240

NACME Scholarships

One excellent source of scholarships for MEP students is the Incentive Grants Program of the National Action Council for Minorities in Engineering, Inc. (NACME, Inc.). Through this program, NACME, Inc. offers block grants to engineering schools who in turn award individual grants to underrepresented minority students.

To be eligible for participation, an engineering school must have at least one program accredited by the Accreditation Board for Engineering and Technology, enroll a minimum of one hundred fifty minority engineering majors or have at least a 6 percent minority representation in engineering, and provide essential support services for minority students such as a pre-freshman program, early monitoring of student performance, student/faculty interaction, and tutoring.

To be selected for a NACME Incentive Grant, a student must meet the following criteria:

1. Be Black, Hispanic, or American Indian
2. Be a U.S. citizen or permanent resident
3. Be an entering freshman or a new transfer student possessing a 2.5 GPA or higher

Awards range from $250 to $2,500 per year. To qualify for an award greater than $500, the student must demonstrate financial need. Students who do not have demonstrated financial need are eligible to receive a merit award of $250-$500 per year. NACME Incentive Grants will continue throughout the student's period of undergraduate study as long as he or she maintains full-time status (at least 12 units per term) and achieves a 2.5 overall GPA.

Engineering schools apply to participate in the NACME Incentive Grants program by submitting a "Request to Participate" form to NACME, Inc. by February 1 of each year. Notification of awards is made on March 15. Although NACME, Inc. is headquartered in New York City, it maintains a number of field representatives who provide technical assistance to universities. For further information, contact:

The National Action Council for
Minorities in Engineering, Inc.
3 West 35th Street
New York, N.Y. 10001
(212) 279-2626

COMMON ERRORS ABOUT FINANCIAL AID

Many MEP students will be the first in their family to go to college. Thus, they may have few personal contacts to whom they can turn when they have questions about financial aid. For all students, but particularly for the MEP students, the process of obtaining financial aid is likely to be confusing. Such confusion can lead to error. Six of the most common—and most harmful—mistakes students can make are:

1. Students think they are not eligible, so they don't apply.
2. Students submit an application for admission and think that it also serves as an application for financial aid. When asked if they have filled out an application for financial aid, they will answer in the affirmative, because they are unaware that financial aid requires its own forms.
3. Students fill out the campus application for financial aid but not the FAF (or SAAC in California) that is required before financial aid can be considered. Or, some students fill out the FAF and not the application for aid at a particular campus.
4. Students apply for aid late or—worst of all—after a deadline.
5. Students who receive financial aid one year forget to apply again in succeeding years.
6. Students fail to keep copies of every item and application they have submitted.

Any one of the first five errors can effectively exclude a student from receiving financial aid. The last error can produce more confusion. MEP staff should take special care that students do apply, apply correctly, and apply on time.

CONCLUSION

The process of obtaining financial aid is complex in that there are so many steps, so many applications, and so many programs. But all the steps are documented. All the forms are available with explanations. All of the formulas have been developed and tested. Applying for financial aid is therefore primarily an exercise in going through each step in proper sequence from the first to the last task.

For the MEP staff member, the lesson is to recognize that one can provide genuine and valuable advice without having to know all there is to know about financial aid. It is essential that MEP staff know basic information, transmit only correct information, and know where to go or where to refer the student when necessary and appropriate.

CHAPTER 13

Pre-Professional Employment

by Chenits Pettigrew and Kathryne J. Kelsick

University of California at Los Angeles

INTRODUCTION

The importance of pre-professional employment—including co-operative education, internships, summer jobs, and part-time employment—to the career development process of minority engineering students cannot be overemphasized. Students should not only be encouraged to participate in pre-professional employment, they should also be encouraged to seek several positions during their academic careers. Students who have pre-professional experience normally have more success in securing career employment following graduation. They also have the opportunity to explore various career options in engineering before deciding on which specialization to pursue. Earning money to defray educational expenses is another benefit. Most important, as a result of these experiences, students are more capable of making well-informed decisions about their educations and careers.

Because of their close contact with MEP students and their relationships with industry, the staff of an MEP program is in an excellent position to assist students in gaining pre-professional employment. MEP students, particularly freshmen and sophomores, will need assistance both in identifying opportunities and in preparing to apply and compete successfully for positions. Certain university offices, such as the co-op/intern office and the office of career planning and placement, should be utilized, and the student should be required to take as much initiative as possible.

CATEGORIES OF PRE-PROFESSIONAL EMPLOYMENT

Just what is pre-professional employment? It can best be illustrated by a brief discussion of four basic categories: co-operative education, internships, summer employment, and part-time employment. The following sections discuss the differences and similarities between these.

Co-operative Education

Co-operative education (commonly known as "co-op") is usually a formal academic program that is an integral part of the students' total educational experience. It normally requires that a student meet and maintain certain academic standards. It also requires that employers conform to certain institutional guidelines. Since it may bring academic credit to the student, it is generally closely monitored.

The time commitment for the co-op experience varies with the structure of the program. It might involve a concurrent schedule of coursework and employment or it might require that the student alternate between periods of school and full-time work. The concurrent co-op model requires that the student be able to manage academic and work responsibilities simultaneously. If a student cannot balance these demands, then this type of work experience will not be productive. Although the time spent working under the alternating co-op model does not conflict with a student's academic responsibilities, it usually extends the graduation date since the student is required to take a leave of absence from school for one or more terms while engaging in the co-op assignment.

Whether the co-op involves concurrent or alternating employment, it offers several potential benefits. Students have valuable career experiences and they earn money to meet educational expenses while remaining in close contact with the academic community.

Internships

Some students gain pre-professional employment experiences through participating in an internship. Like a co-op position, internships are formal experiences and may involve meeting and maintaining similar requirements. In addition, the employer has done extensive planning. Usually advanced students take internships for the purpose of acquiring "hands-on" experience in a selected field. Often internships do not involve compensation. The primary goals are to expand knowledge and to gain experience.

Summer Employment

By far the most sought after type of pre-professional experience is summer employment. This fits well with the academic cycle since it does not extend the graduation date and there is no conflict between work and study.

Like a co-op program, summer employment allows students to gain valuable career experience while earning money. However, students are less likely to be monitored as closely as they would be in a co-op program, if at all. The competition for summer positions is intense, so it is critical that the student begin the

search early and use all available resources effectively.

Part-Time Employment

Some students can and do participate in pre-professional employment during the academic year on a part-time basis outside of a co-op program. The opportunity for part-time employment is high for universities located in highly industrialized areas. Part-time employment often results when companies encourage students who work for the summer to stay on part-time during the academic year. Although this may benefit the company's affirmative action program, it may or may not be of benefit to the student. Studies have shown that working more than ten hours a week tends to have a detrimental effect on academic performance. The decision as to whether or not to work part-time during the academic year involves consideration of the students' financial situation, academic potential, and desired rate of progress toward graduation. If the student works, a reduced academic load should be considered. Experience has shown a reasonable guideline to be:

Hrs./week of work	Academic load
0 - 10	Full (16 units)
10 - 20	3/4 (12 units)
20 - 30	1/2 (9 units)
30 - 40	1/4 (6 units)

BENEFITS TO STUDENTS

As previously mentioned, an important benefit of pre-professional employment is that it provides students with an opportunity to explore career options prior to selecting a major course of study. Often students select an educational program based on misconceptions and limited information. They may believe they have a pretty good idea about what a particular major entails; they later discover, however, that they have made an inappropriate choice because of sparse information. Pre-professional employment provides students with the opportunity to explore various engineering disciplines and work settings. As a result, students are in a better position to make informed and valid career decisions.

An immediate reward of working in a pre-professional position is earning money. This provides students with a sense of independence and maturity while enhancing self-esteem. It also provides extra incentive to remain in school, especially if participation is contingent upon academic achievement. However, as previously stated, the primary goal of pre-professional employment is to provide an opportunity for students to apply their education, skills, abilities and interests. Compensation, although important, should be secondary.

As a result of a pre-professional work experience, students are likely to become more motivated because they are better able to relate their academic experience to the world of work. They realize that earning their degree will give them advantages when they begin their career employment.

Seeking and finding pre-professional employment is a dress rehearsal for the career search they will ultimately undertake. It is important that they develop the requisite skills to compete for the employment opportunities that will later be available to them. In order to accomplish this preparation, students need to be formally exposed to the mechanics of the job search as well as to the importance of career and life planning.

It should be noted that pre-professional experience enhances the marketability of students seeking permanent employment. As a result of their experiences, students have more defined career goals and interest. Therefore, they are better able to relate these interests to the interests and needs of potential employers. The pre-professional experience is very helpful during the students' transition from school to work. Prior experience means that the demands and challenges of the work environment will not be new and overwhelming. They have developed confidence about performing in such an environment.

STUDENT PREPARATION

For a pre-professional employment experience to achieve maximum success, students must be prepared to participate. In order to do so, they must assess themselves, learn how to write, practice interviewing techniques, acquire some knowledge of organizational behavior in general, and learn something about the specific companies that interest them.

Student Self-Assessment

Without a reasonable understanding of themselves, students will be at a disadvantage when competing for, securing, and performing in pre-professional positions. Early in their academic careers, students need to examine critically their personal characteristics, identifying likes, dislikes, strengths, weaknesses, and values as these relate to particular work environments. By identifying pronounced personal preferences, students are able to avoid selecting those positions where chances for success might be greatly reduced. For example, self-assessment might reveal that a student does not like to be confined for long periods performing one particular task, or that a high pressure work environment is unappealing. By analyzing themselves, students are in a better position to realistically evaluate pre-professional employment positions prior to making commitments.

A number of publications on the market are designed to aid students with self-assessment. (*28 Days to a Better Job* by Tom Jackson, Hawthorne Books, Inc., New York, and *What Color Is My Parachute* by Richard Bolles, Ten Speed Press, Walnut Creek, California, are two helpful guides for this process.)

Resume Preparation

A resume is perhaps the most important document that students will prepare. Consequently, they should receive professional assistance where necessary.

Most students seeking pre-professional employment have very limited work experiences to put in a resume. However, this does not mean that they cannot bring certain skills to a position. Most students are unaware of skills acquired through related activities. For instance, many of them have belonged to various campus and community groups where they learned organizational, interpersonal, communication, and leadership skills. In preparing the resume, those activities and skills certainly should be highlighted.

The resume should state a clearly-defined employment objective. This aids the prospective employer in matching students with a suitable position. However, the employment objectives should not be so specific as to screen a student out. To support the employment objective, the resume should emphasize course work which pertains directly to the sort of position desired. It is also in general a good idea to briefly indicate knowledge gained from the course. This can be accomplished by giving a short description of each course on a separate page. The emphasis on course work is particularly important for those students who lack work experience.

A number of students erroneously think that nonrelated work experiences should not appear on the resume. Most kinds of work experience are valid; they indicate that the student has the basic skills necessary to function in a work environment. Before composing the resume, the student should list all classes taken to date, employment experiences, campus and community activities, and all honors and awards. Once this has been accomplished, the task is to sift through this information, selecting the data that would give the best representation. The student shouldn't overlook information that seems to have little relevance; it might be that this information can be realistically and creatively incorporated into the resume. There are a number of guides on the market designed to help students put together an effective resume. However, a word of caution: each student is unique, with different experiences. Thus the material should be used as a guide only, with room left for creativity.

Interviewing Skills

Acquiring the skills necessary to interview effectively is as important as learning to prepare an effective resume. Although interviewing produces tension for most people, students can reduce their anxieties if they have a forum for "dress rehearsals." For example, an interview session can be presented to a group of students with a basic explanation of what occurs during the process. The session can cover those questions employers are most likely to ask. (A sample list of these questions is given in an Appendix to this chapter.) Simulated interviews can be held on a one-to-one basis, with a staff member assuming the role of recruiter. A mock interview situation will allow students to improve their interviewing skills.

Learning About Organizations

Unless the student knows something about the company to which the resume will go, the preparation is incomplete. The student needs to know what the company produces. Access to company brochures and other related materials can give students basic information about different companies. The student study center or MEP office should contain such information for those companies that support the MEP program. For companies of general interest, students can likely obtain information in the Placement Center or in campus libraries. In addition, students can request information directly from a company, if otherwise unavailable. Students should be aware of organizational behavior in general as well as having specific information about particular companies. The result of being more familiar with the characteristics of a specific company is that students will be more prepared for the interview process. Together with specific information, knowledge of organizational behavior will assist in their adjustment. They will become cognizant of the work environment and how to be successful in it.

Student preparation is no small feat. The MEP director should make sure that it is formally structured into the program. It should also be noted that the Career Planning and Placement Center is a valuable source of assistance to a student preparing for pre-professional employment.

STUDENT AND MEP STAFF RESPONSIBILITIES

The collaboration of MEP staff and students is necessary for students to prepare for and secure pre-professional employment. MEP staff should not assume the entire responsibility for this process; MEP students must be actively involved. In seeking employment, students should:

- Assume the responsibility of providing accurate information for the purpose of preparing the resume
- Assume responsibility for acquiring interview skills by participating in available seminars, workshops, training sessions, etc.
- Participate in all available employer exposure opportunities, including career days, job fairs, interviews, etc.
- Make application for available positions and follow-up with employers.

Once a student is placed in a pre-professional employment position, the student should establish and

maintain self-evaluation records which contain the following information:

- Company name
- How the position was obtained
- Expectation from the experience
- Name of the immediate supervisor
- Communications with the supervisor
- Comments from other concerned persons
- Positive and negative aspects of the experience
- Overall comments

By taking an active role in the total process of pre-professional employment, students are in a better position to ensure that these positions meet their needs. Moreover, by maintaining a written self-evaluation, students are able to ascertain the validity of the experience, make a comparison with future experiences, keep accurate records of job duties, and provide MEP program directors with written documentation.

Among the ways MEP directors and staff can assist with the entire pre-professional employment experience of MEP students are the following:

- Assist students in establishing goals prior to the pre-professional experience
- Assist students in preparation of resumes and development of interviewing skills
- Contact employers to identify specific employment opportunities
- Be aware of resources and services available through other campus offices and refer students to these offices
- Be certain that students are matched with appropriate positions, particularly with regard to major, student preference, and affirmative action-tracking records
- Make certain that employers understand the purpose of pre-professional employment
- Schedule intermittent evaluation sessions with the student and employer
- Call the student periodically to find out how the work experience is affecting coursework
- Prepare a comprehensive written evaluation when the experience terminates that can serve when making additional referrals for that particular student or when referring other students to the same employer
- Determine if upon graduation the student received and accepted an offer from the pre-professional employer

COLLABORATION WITH CAMPUS OFFICES

In attempting to develop an effective pre-professional employment component of an MEP, the director should identify the departments, services, and individuals on campus capable of supporting these efforts. Once identified, a collaborative relationship ought to be defined in order to provide services that are optimally tailored to the needs of MEP students.

The Career Planning and Placement Center (CPPC) is a vital source of services and information relevant to pre-professional employment. Its resources generally include summer job listings, part-time job listings, internship listings, employer information, and employer contacts. Most CPPCs conduct various workshops related to career planning and the job search process. It is responsible as well for the coordination of Career Day programs, both those for the general body of students as well as those restricted to specific groups of students such as technical majors, minorities, and women.

There are two other offices that offer possibilities for productive linkages: the Cooperative Education Office and the Internship or Experiential Learning Office. In addition, faculty as well as alumni should be contacted to assist in developing pre-professional employment positions. Often they can provide vital information and input to students regarding employment opportunities.

A well-designed collaborative effort in which the MEP program utilizes all available campus resources can be the most cost-effective approach while still meeting the specialized needs of MEP students.

MEP SUMMER JOB PROGRAM

Consistent with available staff and resources, the MEP may want to establish a formal summer job program. Summer job placement should be given a high priority because a large fraction of MEP students would benefit from this type of experience and because other campus offices, such as the office of career planning and placement, may not offer much help to the student in this area. The basic process of placing students in summer jobs can be stated simply: identify the pool of students seeking summer employment, identify the available jobs, and match students with jobs.

Assessing Students

One of the best ways to identify your pool of students is to develop a resume for each student seeking MEP assistance in finding a summer job. This can be facilitated by having a resume form which each student fills out and from which a resume can be typed. In determining how "employable" each student is, three factors must be weighed: (1) the student's achievement, i.e., how near is the student to graduation; (2) the student's potential, probably best indicated by grades in course work completed; and (3) the student's personal traits. Companies are generally much more interested in juniors and seniors but will sometimes take freshmen and sophomores who have a strong academic record and favorable personal traits.

Developing Employment Prospects

The MEP director should put together a list of prospective employers from all the possible sources: the campus placement office, faculty, industrial supporters, members of professional organizations, and engineering alumni. Alumni, especially MEP graduates, can act as liaisons between the program and their current employers. Accumulating the list of prospects should be an ongoing activity, with the director always on the lookout for additional employers.

Where no contact with the program has been previously established, the MEP director will probably have to begin by approaching the company representative who is responsible for administering its summer job placement. This person usually merely collects applications and circulates them to line managers for consideration. After an initial contact, the MEP director should try to reach the people who can actually make a commitment to hire a certain number of students: the personnel manager, industrial relations vice-president, or even higher executives of the company.

The ideal situation is for a company to agree to take on a regular basis a number of students recommended by the program. Companies tend to be reluctant about such specific commitments because they prefer remaining flexible to changing economic conditions. However, a company which accepts this arrangement and receives top quality students will be likely to continue it. It is also desirable to have companies conduct interviews on campus. The face-to-face contact and the investment of time can spur a company's sense of commitment to employing the program's students.

The MEP director who has pursued all the avenues for developing summer employment will ultimately have an extensive data base. The information on each company should contain the company name, person to contact, the type of opportunities the company can offer, and evaluations of prior student employment with the company. In addition, if the company has any specific requirements—such as students in certain majors, minimal level of coursework completed, citizenship—these should be noted. All this information should be updated regularly and new items added whenever circumstances provide further access to prospective employers.

EVALUATING STUDENT EMPLOYMENT

There are several reasons for evaluating the pre-professional employment experiences of MEP students. Determining the student's performance can suggest areas for improvement and future interests. How the company treated the student can be useful to know before recommending other students for similar positions. Moreover, the program's relationship with the company can be strengthened if the director actively seeks to make the experience as positive as possible for both student and employer.

As part of their obligation to assess themselves, students must assist in evaluating their experience on a job. The MEP director can ask each student to write such an assessment. Did the job meet the student's expectations? Did the student receive adequate supervision? What did the student learn about engineering and about working in a company?

At the same time, any feedback from the employer about the student's performance is valuable. Negative as well as positive reactions should be addressed. If the MEP director can get the employer to evaluate the student not only in terms of one situation but in terms of the program's goals, the discussion can improve understanding and perhaps lead to further commitment.

Where students accept employment after graduation is also part of the evaluation that should be made of their pre-professional experiences. The number of students who are offered and accept employment from a company where they first had an internship or other pre-professional experience is one measure of the program's success.

CONCLUSION

Pre-professional employment is critical to the educational and professional development of MEP students. The MEP staff can aid students in both preparing to seek employment and in identifying specific opportunities. The student should be expected to take a major responsiblity in this process, and various campus offices and resources should be utilized to the greatest extent possible.

APPENDIX

Sample Interview Questions

The following is a list of questions recruiters commonly ask students during an interview:

PERSONAL ASSESSMENT

- What are your professional employment interests?
- Where do you hope these interests will lead?
- Have you formulated any plans as to how you can channel this interest in this direction?
- What specific goals, other than those related to your selected occupation, have you established for yourself in the past, in the future?
- What rewards are most important to you in a career?
- What motivated you to select your present career objective?
- What do you consider to be your strengths and weaknesses?
- How would you describe yourself?
- What major difficulties have you encountered and how did you deal with them?

ATTITUDE TOWARD WORK

- In what way has your college and work experience prepared you for this position?
- What do you think it takes to be successful in our organization?
- How do you determine or evaluate success?
- What significant contribution do you think you can make to our organization?
- What would be your description of a manager?
- In what kind of work environment are you most comfortable?
- What jobs have you held and which proved the most interesting? Why?

EVALUATION OF ACADEMIC BACKGROUND

- What was your most rewarding college experience?
- Why did you select this university?
- Why did you decide on a technical major?
- What was your most boring college subject? Why?
- If you could, would you plan a different course of study?
- Do you plan to seek a more advanced degree?
- Are your grades a good indication of your academic achievement?
- In what ways has participation in extracurricular activities been beneficial to you?

KNOWLEDGE OF THE ORGANIZATION

- Why do you want to work for this company in particular?
- What do you know about the company?
- Is the size of an organization important to you?

CHAPTER 14

Developing Faculty Involvement

by Enrique Ainsworth

California State University, Northridge

INTRODUCTION

As university efforts to increase the number of minority engineers shift from the identification and recruitment of minority math/science talent to retention and graduation, one factor--engineering faculty—emerges as the salient force affecting program effectiveness and student survival.

The numerous roles that faculty play within the university system and the special relationship that they have with students directly affect both minority engineering programs and student retention levels. Yet faculty involvement in minority engineering programs is a difficult and complex subject because the underlying problems and solutions lie more in the area of interpersonal relations than in any other. The purpose of this chapter is to explore the problematic issues surrounding the involvement of faculty in minority engineering programs and to suggest ways to bring about a high level of involvement. First we must know with whom we are dealing—the professors of engineering.

A profile of engineering faculty reveals that they are mostly white males from middle- and lower-middle classes who were educated during the fifties. They are bright, logical, "no-nonsense" problem solvers and researchers. They tend to be poorer listeners than non-technical faculty and are most adept as information givers, problem solvers and one-way communicators when dealing with others. Many are not student oriented and may be disdainful of both the special support programs provided for students of color, and the non-technical, non-faculty, minority adminstrators who run them.

In his presentation at a 1982 NAMEPA Region C seminar, Dr. Frank Hale[1] took issue with the "I made it on my own merits, why don't they?" attitude that engineering faculty frequently exhibit. "Such an attitude," he said, "fails to bear in mind the degree to which white males have influenced and made progress quite apart from matters of native intelligence or aptitude, by their family background, their socioeconomic origins and their political connections in moving into the rewarding and prestigious realms of education, occupation and society in general." The white male engineering professor often tends to discount the advantages he has had when considering the needs of minority engineering students.

Complicating this profile are the attitudes that foreign-born engineering professors bring. As low university salaries force American-born Ph.D.'s to seek higher salaries in industry, engineering schools have responded by increasingly filling their ranks with foreign-born and trained Ph.D.'s. Representing the "cream" of their respective countries, these professors are generally unaware of the history of racial and cultural dilemmas in the U.S.

With this profile in mind, let us now see how the engineering faculty can affect minority engineering programs. In a university, faculty have substantial advisory power over the uses of resources; that is, they influence the allocation of money, space, and personnel. They help decide upon the issues and policies of admission, graduation, and curriculum. They are in a position to influence policy regarding the establishment of auxiliary programs, the solicitation of industry contributions, and the management of project grants. They can provide connections to higher administration and can significantly contribute to the success or failure of a program through their advocacy or hostility.

Thus, many vital MEP interests rely on faculty support. Even if the program emanates from the Dean's Office or higher and so might seem to escape faculty influences, the general support of the engineering faculty can be critical. People in deanships and other high administrative posts come and go, and with them can go years of cultivated support for the MEP. In the long run, it is more judicious to have the widespread support of the engineering faculty rather than the backing of only one or two administrators. Given the power and influence which the engineering faculty wield, it behooves the program to do everything possible to make the faculty its ally. But other considerations affect faculty involvement in an MEP.

Faculty are considerably independent, self-governing contractors and can take on any role via grants, research projects, or consultantships. However, writing, research, teaching, and departmental committees are central to their academic self-interest. The "publish or perish" environment rewards these activities through tenure and promotions, but there are few rewards or incentives for involvement in minority engineering pro-

grams. Additional institutional constraints such as impaction due to over-enrollment force MEPs not only to compete with faculty interest for space but also to defend the presence of minority students as engineering admission slots become scarce. The involvement of faculty with MEPs must therefore center on areas in which the faculty's roles and interests coincide with MEP concerns. One key area is their relationship with students.

IMPORTANCE OF FACULTY-STUDENT RELATIONS

The quality of faculty-student interaction is widely known to have great impact upon student retention and performance. In a 1980 national study, "What Works in Student Retention," Beal and Noel[2] found that the most significant factors affecting student retention were student-faculty relations. In particular, the study showed that the two most important factors causing student dropouts in four-year public institutions were inadequate academic advising and inadequate student-faculty contact. Conversely, the most important positive factor contributing to student retention was the "caring attitude of faculty and staff." In an earlier study on minority graduate students at UC Berkeley, Duncan[3] found that while four out of nine white students felt faculty interaction had frequently inspired them to excel academically, only one in nine minority students reported such experiences. These and other studies indicate that faculty involvement is a pivotal factor in student retention and motivation, that minority students tend to have less positive experiences with faculty than white students, and that ultimately the interpersonal relationships arising out of care and concern are the pertinent controlling factors.

"Care and concern" include such things as positive feedback, encouragement, and recognition of improvement or unique effort. They are derived primarily from small behaviors (many non-verbal) that faculty transmit—an approving nod, an invitation to the office, a few extra minutes spent with the student—and can mean the difference between an engineering student having a sense of belonging or a feeling of alienation. The need to belong, a strong concern of all students, is particularly critical to minority students. Faculty are in the most powerful position to generate behavioral signals that indicate to students whether they belong or not. Since minority engineering students are still few in number and noticeable in the engineering environment, these signals take on added charge.

To underscore the importance of these behaviors, we might note that females, whether White, Hispanic, or Black, have been better represented historically in other professions, like nursing and teaching, than they have been in engineering. There is a reason for this. It certainly is not an issue of competence. The reason is that they have faced overt discrimination from faculty based on historically sexist stereotypes. The few women who have endured the consequent hostility and ridicule and found employment have had to be unusually strong and self-motivating. The rest have succumbed to the pressures of "you don't belong here," and they have left engineering.

Engineering faculty do display care and concern, but it is mostly toward students who look like them, think and behave like them, and talk and act like them. Typically, these faculty are not aware of the partiality in their behavior and of the substantial effect they have on students.

Faculty roles within the university create varied interactions with students; they give rise to numerous opportunities to exhibit attitudes of care and concern. As lecturers, lab instructors, academic advisors, counselors, and mentors, faculty interact with students in the classroom, during formal advising meetings, during office visits, in lab sessions, department offices, snackrooms, and—on a more casual but equally important basis—in hallways and other informal campus locales. Most of these interactions are one-to-one interpersonal encounters. Care and concern at those points become crucial signals of belonging that will foster confidence-building and success on the part of the student. As Lee Browne[4] explains, "Some needs which are common to all persons include belonging, being accepted, achieving recognition, attaining some level of success, having basic needs met, and having some symbols to emulate."

Unfortunately, institutional biases frequently impede the achievement of these basic needs for minority students. Unprepared or sensitive students face a dilemma. Minority students must not only come to the university already competent and prepared to pass tests consistently; they must also learn to contend with tacit racism like "the practice of ignoring the raised hands of minority students."[1] They must adjust to the scarcity of minority engineering students as tutors, monitors, graduate assistants, and research associates—visible signals that the School of Engineering does not place much value on minority input or achievement.

Thus far in our discussion of faculty involvement, we have highlighted considerations and issues that directly affect MEP programs and students. We have pointed out problems that may be posed by the institution in general and the engineering faculty in particular. We have identified and argued for student-faculty interactions as the key to improved minority student retention. And we have defined the key ingredient in all student-faculty interactions, the faculty's demonstration of care and concern which will translate for the student into a sense of belonging and the motivation to succeed. We will now turn to a discussion of ways in which faculty can contribute to and be involved in minority programs.

FACULTY ROLES IN MEP

Faculty involvement in MEPs can take at least two

forms: interacting directly with students and/or providing administrative and political support. Direct student contact is part of the regular faculty duties. Thus in their regular roles as teachers, academic advisors, and mentors, faculty are in a position to meet the greater academic needs of minority students, and help them meet their personal needs.

A mentoring system is one of the best and most effective ways to involve faculty with MEP students. A pilot mentoring program established several years ago at the City College of New York illustrates the significant impact that engineering faculty can have on students. At CCNY the retention of civil engineering students dramatically increased as a result of the mentor program. The implication is clear: if a mentor program can have that effect on engineering students in general, a similar program for minority engineering students would likely have a greater impact.

In a mentoring program, selected engineering faculty can be assigned six to ten MEP students for whom they serve as mentors during the students' tenure in the program. Mentoring includes formal duties such as academic advising and career counseling, and a wide range of informal, less specific roles that collectively convey the faculty's interest in and concern for the students. Activities in this latter category can include everything from offering students help with their studies to inviting them to lunch, and from making sure students are progressing satisfactorily in school to stopping by the MEP study center to say hello.

The MEP director and staff must carefully plan and oversee a mentoring system if it is to be effective. Criteria need to be established for choosing faculty mentors, and mentor responsibilities must be delineated clearly and thoroughly. MEP students should feel comfortable approaching and talking with their mentors and, ideally, relationships between the students and mentors should evolve into something more than superficial acquaintances. The MEP director and staff should monitor the mentoring system by periodically checking with mentors and students, holding mentor meetings to identify and resolve problems, and developing ways to measure the effect of the system on the MEP's overall retention rates. Most importantly, a successful mentoring system depends on a cadre of faculty who are both culturally sensitive and able to communicate effectively with students. To develop this cadre, the MEP will likely need to conduct training sessions for the faculty which address these skills. Later in this chapter, a model for a training program of this nature is described.

Faculty who cannot afford to spend the time required to mentor or monitor MEP students can nevertheless become involved with MEP students in other ways. There is always the need for speakers and role models—at orientation sessions for MEP freshmen, at various career awareness programs, at functions and meetings sponsored by the minority engineering student organizations, and at numerous other events. The engineering faculty, especially minority faculty, can significantly enhance an MEP student's motivation to succeed. Whether faculty members address a group of MEP students to convey information about a particular field of engineering or share stories about their background, struggles, and accomplishments, the faculty's manner, style, and mere presence can dramatically affect a student's motivation and perseverance. The influence of these faculty as role models can be one of the strongest motivational factors for an MEP student, and the MEP director would be sorely remiss to ignore this invaluable resource.

The faculty's involvement in an MEP need not be restricted to direct student contact. They can also provide administrative support to the MEP by sitting on advisory boards and governing committees and by serving as advocates for the MEP within the university system. The possibilities for administrative involvement are numerous and can extend far beyond the engineering school. Advisory boards, for example, are most effective when they provide a broad range of experience and expertise to draw from. The best constituted MEP advisory board should therefore include engineering faculty and administrators, plus representatives of key campus offices such as the university admissions office, the counseling center, the financial aid office, the career planning and placement office, equal opportunity/affirmative action programs, and industry.

The faculty's advocacy of the MEP within the university system can be especially helpful. In any one department or school, a senior faculty member often possesses the power to enhance or impede a program, and this can carry over into other areas of the university. Sitting on university-wide committees that govern resource allocations or curricular matters, such faculty can be significant allies of the MEP by shepherding through proposals and protecting existing policies that benefit the MEP. On campuses where the demand for lecture space, faculty positions, and other resources often exceeds those available, the need for advocates becomes critical if the MEP is to survive.

Last, the faculty can be contracted to perform special services for the MEP. Paying summer stipends from MEP grant monies or arranging with the appropriate dean for release time, the MEP can set forth specific projects or activities for which one or more faculty are responsible. The kinds of work that a faculty member might do for the MEP include developing and coordinating the MEP's summer job program, serving as the liaison person between the MEP and industry, or administering special high school summer programs sponsored by the MEP.

INVOLVING FACULTY

With an understanding of *what* roles the faculty can play, we can now turn to the practical considerations

of *how* to get them involved. The key here is developing personal relationships so that faculty willingly take on extra roles rather than feel compelled to do so. Cultivating such relationships will accomplish the foremost goal of educating the faculty—about the MEP director, the staff, and the program. Having lunch together, dropping by their offices to talk over a problem or share some good news, contacting them about an MEP student's performance, inviting them to an MEP office party or other social function—all of these are obvious but important ways to develop relationships and concomitantly educate the faculty. In addition to personal contact with them, the MEP director should follow up with supplementary tactics such as sending them copies of MEP newsletters and annual reports, arranging for them to address MEP student groups, or inviting them to sit on the MEP advisory board. The MEP director should be as supportive of them as he or she wants them to be of the MEP by showing interest in their work, writing letters of support for them, and defending their ideas and suggestions at meetings. After the director has developed a rapport and camaraderie with faculty, their involvement in the MEP will be a natural offshoot of the relationship. In short, when the director asks them to become an MEP mentor, to monitor a student's progress, to be an advocate of the MEP, or to serve in any of the other capacities noted above, they will agree to it because they will want to do it and will view it as part of their faculty role.

The MEP director, however, cannot expect to cultivate personal relationships with everyone in the engineering school. There are other ways to get faculty involved in the MEP. Almost every faculty member possesses some expertise or occupies a position that can benefit the MEP in some way. Department chairs, for example, can be invited to conduct orientation sessions to inform MEP students about their major. Or the director of the engineering school's research center could be asked to earmark one of the school's research projects for an MEP team. Or a popular, respected professor of an engineering service course could be approached to teach a section especially for MEP students. In all these instances, the faculty are not asked to do something new or different, but merely more of what they already do—and do best.

So far in this discussion we have covered issues central to understanding faculty roles and ulitizing their influence. We have clarified the powerful effect faculty can have on students and addressed ways to neutralize the negative aspects. We have delineated ways that faculty can be involved with MEPs. It should be quite obvious to any MEP director that the process of developing faculty involvement is ongoing and may take years, and, as stated in the introduction, it is very much dependent on subtle interpersonal relations. Given this perspective, a formal training program can be used to great advantage in securing faculty support.

FACULTY TRAINING

A faculty training program is a management device, not unlike an intensive "quality circle," that an MEP director can use to the benefit of both the MEP and the faculty trainees. The training program not only provides the faculty with the rationale and skills they need to deal effectively with the MEP and its students, but it also enhances *all* of the faculty's interpersonal dealings. Further, a formal training program will, in a very short time, catalyze close friendships between the faculty and MEP director, and provide a viable springboard for the faculty's subsequent involvement in the MEP.

The following sections describe a model faculty training program developed over the past four years at California State University, Northridge. The program called FAMES (Faculty Advisors for Minority Engineering Students) has the objective of developing a cadre of engineering faculty who would be effective academic advisors, personal counselors, mentors, and role models for ethnic students. The highlights of the FAMES program are described here. A detailed dissemination document is available on request.

The FAMES Program

The FAMES program has three major objectives: (1) recognizing the errors of "naive counseling"; (2) learning the theory and techniques of the therapeutic counseling process; and (3) studying the social, political, psychological and economic factors of minority cultures. The format of the training sessions allows for lectures, discussions, videotaped counseling exercises and subsequent critiques, and actual student advising. The faculty are exposed to guest lecturers, scholars, experts, and theatrical performers.

Faculty participants are selected and interviewed on the basis of recommendations of past trainees, departmental personnel, students, and their expressed willingness to take part in the project. They receive three units of released time to attend training sessions for four hours a week for a sixteen-week semester.

The training program is based on the following assumptions:

1. Students will often come to the faculty during academic advising or normal office visits with ostensibly academic questions. In reality, they use this as a cover to discuss deeper issues involving life stress (personal problems, loneliness, motivation, need for positive feedback, etc.). This is a general occurrence and the faculty will frequently find themselves playing the role of the counselor.
2. As profiled earlier, faculty members, especially in the technical fields, very rarely come equipped with the training necessary to undertake these roles. Even the "care and concern" they display to the selected students is demonstrated with inadequate interpersonal skills.

3. When students are faced with this situation—approaching an advisor for academic advising and any other underlying problems—their meeting with a faculty member can be critical, especially when the latter is not aware of the complex nature of the students' problems.

4. A minority student in a one-to-one advising is "on guard" for the slightest negative input. Professors deemed approachable are extended a small margin of trust and the student scrutinizes the content and style of any interaction that takes place. Most professors are unaware of the delicacy of the advising process with minority students because of a profound lack of knowledge of the dynamics of interpersonal communication and of the relevant ethnic cultural history.

5. Mentorship of minority students, in particular, requires a high level of interpersonal skills and intercultural sensitivity. As engineering professor Phillip C. Wankat stated in his article "The Professor as Counselor," "For engineers . . . probably the hardest to learn are the listening skills used . . . where it is necessary to focus on feelings and gain rapport."[7]

6. A counseling training program based on crisis intervention theory and intercultural experiences can improve both the quality and the quantity of individual interactions between faculty and their MEP students—and, indeed, with all of their students.

The primary method used in FAMES is combining the recognition of the errors of "naive counseling" with the gradual acquisition of skills of developmental counseling; and, as the emotional readiness of the trainee group evolves, introducing increasingly complex intercultural issues and experiences. To promote this multifaceted growth, the faculty involved have to become a group, a subculture wherein it is safe to disclose feelings, observations, and personal experiences, and to receive criticism. This feeling of security is crucial because interracial experiences have been shown to give rise to much defensiveness, anger, and resistance.

The program addresses two major subject areas: counseling training and ethnic perspectives. Below is a brief description of what each area entails.

1. *Counseling Training* — The goal of counseling training is to improve the faculty members' effectiveness as counselors. This is done by contrasting "naive counseling" with effective developmental counseling, in part by reviewing videotapes of participants' counseling sessions with students conducted prior to the beginning of training. By reviewing their own taped counseling sessions, the faculty trainees are quick to see evidence of their naive counseling traits—which can be characterized as highly directive, anxiety-centered, content-focused, goal-oriented, impersonal, and given to one-way communication.

An important part of effective counseling is proper listening skills. Most of us have been trained not to really hear, not to really feel others' messages. Thus, special attention in FAMES is devoted to teaching the faculty trainees through experiential activities and practicum to:

- hear holistically, perceiving not only the *content* of the student's discourse, conveyed through his or her words, but also the *feelings* of the student, exhibited by his or her behavior
- suspend judgment, if only temporarily
- focus on the student, controlling or eliminating any distractions
- wait for the student to initiate discussion
- accurately grasp the nature of the student's problem (trying to repeat it verbatim is a good check)
- look for common elements in the student's discourse, themes that might be repeated.

2. *Ethnic Perspectives* — The intercultural training serves three purposes. It enhances the faculty's effectiveness as counselors of minority students by teaching them the limitations of conventional academic communication styles and the implications of ethnic verbal and non-verbal communication. It educates the faculty about the history, culture, and psychology of ethnic cultures. It makes the faculty aware of coping strategies and behaviors that young minorities adopt and the costs they pay for success or failure in the dominant American culture.

Expected Outcomes and Schedule

FAMES' counseling and ethnic training is intended to change the faculty's awareness and attitudes, in particular their sensitivity to and communication with minority students. To achieve these ends, the program at CSU Northridge is organized around three primary modules:

Module (A): *Naive Counseling and Intercultural Issues.* Sessions #0, #1, #2, #3 & #9. **

The objective of these sessions was to provide a practical understanding of inappropriate interpersonal communication and to enable the participants to recognize behavioral errors in counseling approaches and their effects on minority students. Emphasis was placed on orientation and culture-building among the trainees.

Module (B): *Theory and Techniques of Therapeutic Counseling Process.* Sessions #4, #5, #6, #7 & #10. **

The objective of these sessions was to provide in-depth exposure to the workings of developmental counseling. Practice in controlling the creation of respect for interpersonal relationships was emphasized by lectures, exercises, listening techniques, and practice in the reading of non-verbal cues.

Module (C): *The Social, Political, Psychological and Economic Determinants of Minority Cultures.* Sessions #8, #9, #12, #13, & #14. **

The objective of these sessions was to inform the participants how the history and oppression of ethnic cultures affect the economic, psychological, and social relations between American minorities and non-minorities.

The following is a week-by-week schedule which indicates how the three modules are integrated throughout the semester:

Week

0 **Pretraining Tapings**

Prior to training, each faculty participant is videotaped during a 20-minute counseling session with an underachieving MEP student.

1 **Orientation**

Norm setting; building group culture of faculty trainees, overview of developmental counseling process.

2 **Issues in Naive Counseling**

Elements of naive counseling; discussion on ethnic/majority culture interractions; review of pretraining tapes.

3 **Critiques of Pretraining Tapes**

Recognition of naive counseling errors; continued review of counseling tapes; exercise in stereotyping and its effects.

4 **Phases of Therapeutic Counseling — Relationship, Exploration, Personalizing, Action**

Practicum: Relationship, attending, nonverbal communication.

5 **Counseling Training — Rapport and Listening Behavior**

Rapport, pacing, respect for values, building trust; listening, suspended judgment, non-directive communication, empathy, listening for content/feelings.

6 **Exploration — Selective Focusing — Problem Identification**

Selective focusing, here and now behaviors; problem situation, emphasis on feelings/meanings.

7 **Exploration — Process Empathy and Impasse**

Practicum: Process empathy, integration of all skills; impasse, confrontation techniques.

8 **Political and Psychological Views of Minority People**

Ethnic world views; coping strategies for minority students.

9 **Sociological and Interpersonal Parameters of Intercultural Communication**

Issues in counseling students of color.

10 **Personalizing — Process Empathy — Problem Resolution**

Aiding a student in facing impasse and accepting responsibility for change.

11 **Personalizing — Process Empathy — Problem Resolution**

Process empathy; problem resolution, confrontation and termination.

12 **Minority Students' Attitudes and Environment**

Minority high school visitation; videotapes of minority students; minority women, double bind.

13 **Black American Cultural Perspectives**

Presentations and discussions regarding Black cultural perspectives.

14 **Hispanic Cultural Perspectives**

Presentations and discussions regarding Hispanic cultural perspectives.

15 **Closure Session**

Review of training; post-training videotapings.

Note that a key factor in the learning process is the use of videotaping technology. The program begins and ends with each faculty participant being videotaped counseling an underachieving MEP student for a 20-minute session. Reviewing the intial tapes early in training serves to increase the faculty members' motivation to develop their skill in the counseling area and the final tapes aid in evaluating the impact of the training. The faculty also videotape mutual counseling sessions throughout the training. In addition, videotapes of MEP students sharing their views about the institution, the MEP program, and how they are treated by the faculty provide an opportunity for faculty participants to hear an open and honest student perspective.

CONCLUSION

Faculty involvement both in terms of administrative and political support and direct involvement with MEP students can be a key factor in the effectiveness of a minority engineering program. However, because of the characteristics of the faculty and the reward system in which they operate, gaining their support and involvement will require a concerted effort over time on the part of the MEP director and staff. A formal training program is an excellent way to develop a cadre of faculty to serve as academic advisors, counselors, mentors, and role models to MEP students.

REFERENCES

1. Hale, Frank, "Factors, Positive and Negative, That Impact on Retention," NAMEPA Region C Proceedings, Columbus, Ohio, 1982
2. Beal, Phillip E. and Noel, Lee, "What Works in Student Retention," American College Testing Program and National Center for Higher Education Management Systems, 1979
3. Duncan, B., "Minority Students," in *Scholars in the Making*, J. Katz and R.T. Hartnett, Editors, Ballangee Publishers, Cambridge, Mass., 1976
4. Browne, Lee, "Developing Skills for Coping," California Institute of Technology, Pasadena Calif. 1978.
5. Reitz, Edward S., "Faculty Mentoring of Undergraduates at City College of New York," *ASEE Conference Proceedings*, Colorado State University, Fort Collins, Colorado, June, 1975
6. Landis, R., Ainsworth, E., Dorsey, D., and Jenkins, M., "Dissemination Document for Faculty Advisors for Minority Engineering Students (FAMES) Program," 1983. (Available from Minority Engineering Progam, California State University, Northridge, Calif. 91330)
7. Wankat, Phillip C., "The Professor as Counselor," *Engineering Education*, November, 1980

CHAPTER 15

Developing Institutional Support

by William E. Hogan II, **Honeywell, Inc.**
and
Nathaniel Thomas, **Illinois Institute of Technology**

INTRODUCTION

Because a minority engineering program (MEP) is based on a university campus, its relationship with the administration and the engineering faculty is an ever-present fact of its existence. An MEP can gain a portion of its funding and other valuable support from outside sources. But grants can run out; federal and state affirmative action policies can change; and industrial sponsors can alter their patterns of giving according to the economic climate. Consequently, a minimal level of institutional support is vital to the program's operation; and an enthusiastic, actively cooperative level of institutional support is highly desirable to ensure the program's longevity and continued success. An MEP needs to be firmly rooted in the institution at which it is located in order to flourish, not only by receiving adequate funding, but also by benefiting from the coordinated efforts of faculty, administrators, and staff to promote the program's goals wherever possible.

There are a variety of forms that institutional support can take and different ways an MEP can be structured within different kinds of institutions, ranging from large, open-admission state universities to privately endowed colleges with selective admissions. These differences, together with particular circumstances in each case, affect the makeup of an individual MEP program—its size, components, and strategic importance to the academic enterprise. There remains, nevertheless, a universal issue—how to secure institutional support above and beyond the bare essentials.

OBSTACLES TO FULL INSTITUTIONAL SUPPORT

Institutions currently face two critical problems that threaten to divert their attention from the needs of an MEP. In general, decreases in funds provided for education have resulted in cutbacks and retrenchment at many colleges and universities. The situation is, however, particularly severe for schools of engineering, which are finding it difficult to attract new faculty and to keep laboratories from quickly becoming outdated. Given the immediacy of these pressing financial concerns, administrators and faculty are prone to award them the highest priority.

Engineering faculty today earn considerably less than they would in private industry. The gap has grown so large that recent Ph.D.'s are not choosing to teach. Black, Hispanic, and American Indian engineers, who could serve as role models and mentors to minority students, are not being recruited into academic jobs. The percentage of foreign faculty is increasing, as is the number of courses taught by part-time faculty. Moreover, many of the best faculty are leaving.

While engineering departments are struggling to hire and to retain faculty, they are also confronting the problem of keeping up with the latest equipment. Budget cuts at a time when technology—particularly in computer science and electronics—is constantly changing can swiftly make laboratories all but obsolete. Yet these shortages are occurring in the midst of increasing enrollments. Since 1975 almost all engineering schools have been overcrowded. Existing laboratory and classroom space is inadequate, and too few required courses are offered to meet the demand. The faculty are further burdened by a heavy advising load and by pressure to keep up with the latest technology. The current situation exacerbates the difficulties of minority students in engineering. They come into a predominantly white environment, often for the first time, to pursue a rigorous course of study with, in many instances, poor preparation. Now, in addition, they enter overcrowded classrooms and meet with overburdened professors.

At least for the present, an institution is likely to view the allocation of the resources necessary to enhance minority students' academic and personal experiences as less essential than faculty salaries and new equipment. The glamour attached to establishing minority programs in the mid-seventies has somewhat dissipated. MEP directors—and those who wish to start a program—must understand thoroughly the point of view of administrators and faculty if they expect to develop a strong institutional commitment. They should minimize as much as possible the idea that an MEP is competing for the same resources required to insure outstanding instruction and quality research. Just as important, they must be prepared to argue for the benefits the program brings to the institution. The rest of this chapter will discuss the institutional support an MEP needs, several models that can be adapted to different kinds of institutions, and the benefits that can and should be stressed to build a case for an institu-

tion's fullest support and commitment.

THE INSTITUTIONAL SUPPORT AND MEP NEEDS

Institutional support can be loosely defined as all the resources that are appropriated to the MEP. The primary support is, of course, financial: the institution gives the program operating funds. Financial support can also take the form of office space, utilities, the loan of clerical and other staff, supplies, equipment, and mailing privileges. An institution can budget these expenses in a number of ways, but overall they represent the extent to which a college or university is willing to underwrite the program.

It would be inaccurate, however, to think of institutional support solely in financial terms. An administration that is highly committed to the program can provide less tangible support that is nonetheless very real, as can committed faculty. The MEP director should strive to develop a relationship with the institution that encourages everyone who can assist the program to feel involved in its success.

Financial Support

Although an MEP cannot be established without a certain degree of commitment on the part of an institution, a functioning program requires a built-in allowance for expansion until it fully serves the needs of all minority engineering students. A stable MEP, if it is to meet its goals, will have basic expenses:

- Director's salary and fringe benefits
- Staff salaries and fringe benefits
- Student clerical salary
- Student tutor salary
- Telephone
- Duplicating and printing
- Mailing
- Supplies
- Faculty release time
- Local travel
- Distant travel
- Student transportation
- Equipment

For some of these items, such as mailing, the institution can simply not charge the program. Most of the expenses, however, will be budgeted from one of the following:

- Engineering school operating budget
- Central university operating budget
- Campus-wide minority program budget
- Student government budget
- State budget allocation for MEP

The size of the staff needed for a particular MEP will depend on the number of students in the program and the variety of services offered. In general, a school that has as many as one hundred minority engineering students ought to have a full-time program director and at least a half-time staff secretary. Similarly, the space requirements will vary according to the size of the program. There should at least be sufficient space for staff offices and a student study center, both appropriately equipped. As the program grows, additional staff and space will become necessary. A rule of thumb is one full-time professional staff member for each one hundred students. The director's office and those of other staff members who counsel students should be private, apart from the distractions of typing, phones and arriving visitors.

Other Forms of Support

Beyond providing for the basic operating expenses of an MEP, a college or university can actively support the program in other important ways. The institution can target existing scholarships for MEP students, and it can seek out new scholarships for them from external sources. Administrators and faculty can initiate federal, state, and foundation grant proposals that will bring funds into the program. All of the support services on the campus, such as admissions, financial aid, and placement can cooperate in an integrated effort to serve minority engineering students.

At a less active level of involvement that is still extremely valuable, administrators and faculty can demonstrate their commitment through verbal and written endorsements. The MEP director will, in most cases, be more likely to obtain this kind of assistance precisely because it demands less time and effort. But an energetic MEP director can then make substantial use of such support. A letter from the college president can open the channel of discussion with a prospective industrial donor. The dean of engineering can recommend that faculty apply for grants that specifically include minority students, and the MEP director can participate in framing the proposal. Even an individual faculty member who is willing to stand up at a department meeting to praise the program can be a precious ally.

To cultivate the continued support of administration and faculty is one of the MEP director's constant tasks. Diplomacy and creative suggestions can have positive results, perhaps not immediately but in the long term. At all times, the director must exhibit effective leadership, good management skills—especially with respect to budget matters—and limitless energy and enthusiasm for the program.

The total scope of institutional support includes the following areas:

- Budget lines dedicated specifically to the program to support a director, staff, and nonpersonnel items needed for operation.
- Nonpermanent financial contributions used for scholarships.

- Fund-raising efforts directed at federal, state, foundation, and industrial sources.
- Verbal and written endorsements by the president, vice-president, deans, and faculty to be used for raising funds and for rallying faculty support within the school of engineering.
- Faculty advisors and mentors for each minority student.
- Support services on campus mobilized for an effective joint effort.

ADAPTING AN MEP TO AN INSTITUTION

The model MEP described in Chapter 2 calls for a full-time director to manage the program and an appropriate number of staff members. This model entails substantial cost to the institution, either as the main source of support or as a partner with industrial supporters. Based on financial and other considerations, an institution may opt to structure an MEP along different lines.

Different Structures

Some institutions link an MEP to campus-wide programs that serve minority students. In this kind of structure, an individual outside the school of engineering looks after the interests of the minority engineering students. While this alternative is attractive and workable in some instances, it has drawbacks. The participation of faculty may be difficult to secure, since the school of engineering lacks major responsibility for the program.

Another alternative is to set up a program under the supervision of the school of engineering but without a full-time director. A member of the engineering faculty or staff is designated to manage the program, much like many English departments that appoint a director of freshman English from among the faculty. As a faculty member, such a person can usually command the respect of colleagues, thereby strengthening faculty commitment to the program.

Both of these alternative models offer advantages to institutions that are not prepared to establish an MEP according to the model in Chapter 2. Industrial sponsors, however, may view such structures as signs that the institution is not wholly committed and may therefore be less disposed to contribute. In any case, the person responsible for the MEP must attempt to broaden and deepen the institution's commitment.

Public and Private Institutions

Some significant differences between public and private institutions can determine the institutional support each gives to an MEP. One factor that often distinguishes an education at a private school is the high cost of tuition. Another is selective admissions. On the other hand, public schools, especially state colleges and universities, can draw on state funds for minority education efforts that are not available to private schools. Furthermore, in states where public universities must admit all residents who have graduated from accredited secondary schools, the number of minority students admitted to engineering will, most likely, be larger than at a private institution; and, due to the open admissions policy, there will probably be enough students who are not academically well-prepared to warrant intensive tutorial services and other guidance services that may be unnecessary at private institutions.

Because of high tuition costs, financial aid and work-study packages at private institutions are of critical importance to minority students. In short, students need more money to attend a private school. Work-study may be the norm, built on arrangements with industry to help support students' expenses. Where a private institution has endowments or other funds available for minority students, these funds can relieve the students who receive them from working while in school.

As part of a selective admissions policy, private schools attempt to recruit outstanding minority students. The result is a higher cost to the private institution, since such students are often provided subsidies regardless of financial need. While the competition to attract the best students benefits those who thereby receive full scholarships and an excellent education, it can cause the decline of a minority program by draining funds that could otherwise be used for its ongoing operations.

A further difference between public and private institutions is the tendency of the latter to fund minority engineering programs—director's salary and that of other administrators and staff, as well as the program components—through grant money. There is then the risk that such funding may be discontinued and that the private institution will not be able, because of internal financial constraints, to take on the cost of the program.

BENEFITS TO THE INSTITUTION

In order to generate a strong institutional commitment that is backed by solid financial support, an MEP director should be an eloquent proponent of the program's merits as they relate to institutional objectives. That does not mean making fine speeches, although a director who exudes confidence and capable leadership qualities will be effective in subtle ways that defy measurement. More important, however, is the ability to translate the desirable social goals of the program into terms that capture the attention of administrators and engineering faculty. Thus, to speak of the benefits that accrue from having a diverse student population, one that more realistically approximates the diversity of American society, appeals to altruistic motives. But in the press of competing claims on institutional funds, it is necessary to buttress this argument with more

quantifiable benefits. Wherever possible, it should be emphasized that what benefits the program also benefits the institution.

Direct Benefits

The MEP director can point to the following opportunities for attracting new resources to the institution as a result of having an MEP on campus:

- Faculty portion of MEP co-authored proposals that get funded
- Portions of foundation grants that are not restricted to the minority program
- Minority scholarship funds from outside sources
- Faculty and student salaries paid by the MEP
- Equipment donations to the school of engineering derived through MEP contracts
- Increases in minority enrollment with ensuing increases in federal or state contributions
- Contributions to the school or to a department from companies introduced to the institution by the MEP director

Indirect Benefits

There are also indirect advantages to the institution that can be enumerated:

- Government proposals can use the MEP in order to show that the school is conscious of minority issues
- A good MEP can attract top minority students who otherwise would not attend the institution
- The MEP can assist the admissions office through presentations at high schools
- Minority awards can enhance the school's image
- The MEP can help to improve community relations

Long-term Benefits

Over time, a well-run MEP benefits an institution in all the ways listed above. Moreover, by allocating resources to address the particular problems of minority students in engineering, an institution is laying the groundwork for significant results that can then be expanded to include all students. Many of the services an MEP develops to improve the success rate of minorities can be applied to the general student population.

For example, the careful attention the MEP staff pays to orienting and advising minority students about the first required engineering courses would help any student entering the field. Methods and tactics that aim at overcoming academic deficiencies—tutorials, students helping students, faculty mentors—have potential for widespread application. The research that explores and then attempts to solve the low retention rate of minority students in engineering can provide valuable conclusions for other students in the sciences. One approach an institution can be encouraged to take toward an MEP is to view it as a pilot program that will turn up new possibilities for improving the education of students throughout the campus.

CONCLUSION

The role of the MEP director in forming a positive attitude toward the program within the institution is to cultivate understanding and commitment at all levels. To do so, the director should if possible obtain regular access, via the dean of the engineering school, to the president or chancellor. The engineering faculty, as a whole and as individuals, should be urged to participate in and support the program.

MEP students should also be guided to act as the program's ambassadors to the rest of the institution, especially with respect to fellow students and faculty. Minority students should, of course, put energy into their own organizations; but they should join and take part in activities with other students. They should invite all the engineering faculty to their social events as well as to informative sessions about the program.

To the extent that an MEP involves the rest of the institution in its effort and shares with the institution the fruits of its success, it will make the best case for its continuing support. Even in difficult economic times, an MEP will then appear to be an integral, important part of the institution.

CHAPTER 16

Developing External Support

by David Blackman

Northeastern University

INTRODUCTION

The goals of a minority engineering program (MEP) are to recruit, admit, retain, and graduate greater numbers of underrepresented ethnic students. Outside funding and other forms of support can help a program reach these goals. It is a rare MEP that does not need more support than its own academic institution can provide; and additional support, especially from private industry, can increase the quality and range of services offered to students. Thus, working relationships with local industries, which are the most likely sources of ongoing support, are vitally important to the success of an MEP at each stage of its operations.

Such relationships can also measurably benefit industrial sponsors. Many of the program's graduates will go on to professional employment in private industry. And those companies that have given their support will gain the satisfaction not only of assisting minority students but also, on a very practical level, will be in a good position to hire well-trained minority engineers. The MEP director must understand and be able to communicate these benefits. This chapter will focus on the methods of finding, cultivating, and maintaining local industry support.

FUNDING SOURCES

There are a number of funding sources that encourage the goals of MEPs. On the federal level, the Department of Energy funds colleges and universities to seek out minority students during junior high school and high school, and to identify, motivate, and prepare them for engineering studies. Some National Science Foundation activities are appropriate targets for grant proposals, as are some defined categories of the Rockefeller Foundation, the Carnegie Foundation, and possibly the Ford Foundation. NACME, the National Action Council for Minorities in Engineering, Inc., gives financial aid to engineering colleges for qualified minority students and links colleges to private industry; chief executives from major corporations sit on NACME's board.

Many corporations such as ARCO, General Electric, and Xerox have established corporate foundations to administer a major share of their educational giving. Most of these corporate foundations will consider proposals for grants to MEPs. (An excellent reference is *Corporate 500: The Directory of Corporate Philanthropy*, published by the Public Management Institute, 350 Brannon Street, San Francisco, CA 94107.)

Valuable as all these kinds of support can be, on the day-to-day level the MEP director is engaged in convincing local representatives of private industry of their mutual interests. The program serves the community in which the industry is based, and it serves the needs of industry by making available a pool of new engineering talent. The rest of this chapter will discuss first how to approach local industries so as to get their support and then, once involved, how to keep them satisfied that their investment is worthwhile.

HOW TO INITIATE CONTACT WITH LOCAL INDUSTRY

The moral and social value of bringing minorities into the mainstream of American education is unarguable; and affording opportunities to minority students that lead to their entering professions in increasing numbers has been, since the 1970s, an area of social service that confers various rewards on those in the private sector who contribute to such efforts. A company can gain an enhanced image, including positive publicity, for helping to underwrite an MEP. But a program director seeking support must be prepared with more than a message about social inequities that ought to be rectified. A strong business-oriented proposal is needed as well. Therefore, careful planning should precede any solicitations.

Preliminary Planning

The process of planning a campaign for industry support has two main parts: (1) an analysis of the program's needs and (2) an analysis of the companies in the vicinity who can be motivated to supply the needs that have been determined. In the preliminary phase, it is necessary to consider not only what amounts and kinds of support could produce ideal results, but what can be accomplished successfully within more realistic limitations. The strengths of the existing program should be documented as well as the weaknesses that can be converted to strengths, given the special expertise of the staff, the established resources of the institution, the group profile of typical candidates for the program.

In evaluating the support needed to carry on and to

improve the program, a director should keep in mind that industry assistance can take many forms, some of which may be obtainable even though outright financial grants may not be forthcoming. Commitments of time and services can help in a variety of ways. A company can, for example, loan one of its employees to the program for a stipulated period. IBM annually loans seventy employees nationwide. Individuals can become adjunct faculty, teaching a course on a part-time basis. The resources saved can be used to support the MEP.

Companies can also donate equipment, both for instructional purposes and for the program office and student study center. Clerical help, materials, and editorial and graphics services for publications can be provided. One interesting possibility is for a company with an extensive training staff to give the program a workshop on effective management techniques. Any of these contributions has the additional merit of involving a company in the program, thereby creating opportunities to demonstrate at close range the need for further contributions to a deserving project. Thus, a sizeable grant for scholarships to minority students or a block grant to the program may follow in the course of forming ties with a company that are, at the outset, less demanding financially.

Before setting off to call on a company, the program director should use to the fullest the college or university's development office. The development staff can help evaluate prospects and can identify others. It can research a corporation's guidelines for giving, its recent grant patterns, and its relationship over a period of time to the institution. For example, the development office can furnish information about the number of alumni employed at a particular company, the names of any alumni who are in decision-making positions, and the number of employees currently enrolled in course work at the institution.

Most important, by consulting with the development office, the program director can coordinate activities to fit into the total thrust of the institution's development projects. If, for instance, a company is currently paying off a major pledge or is slated for a building program request, approaching it on behalf of the MEP may be inappropriate at the present time. On the other hand, if the moment seems ripe, the development staff can informally prepare the way for a formal appeal, and in so doing can assure the prospective donor that the MEP has the proper institutional endorsement.

Once a program director has researched and assessed the corporate environment for promising sources, other informal contacts can be useful. The company recruiters who come to campus are prime examples of possible intermediaries, since the companies they represent are already interested in looking over the engineering graduates. Meeting with the campus recruiter during a break from interviews—perhaps inviting the recruiter to lunch—can lay the groundwork for an appeal. Even if the recruiter is not someone who will participate in the decision to make a contribution, the meeting can produce information about whom to solicit and what the policies are for initiating a proposal. The recruiter can very likely suggest the level of solicitation that would be most favorably received. Moreover, such an exploratory session can result in an introduction to those who do decide funding.

It is of paramount importance throughout the planning phase to translate the aims of the program into terms that are meaningful to the business executives who will weigh an appeal for a contribution. Although a large corporation and a small company may have different internal mechanisms for choosing how they allocate gifts, they all share a common criterion: they are more inclined to support projects that directly or indirectly serve their business interests. Consequently, while the fact that investing in an MEP is socially responsible should be sufficient motivation, an appeal will fare better if the benefits it can bring to a particular donor can be made more tangible. Access to well-qualified minority engineers as they graduate is, of course, the single most persuasive argument to a company that hires engineers. The ability to influence the program is also a powerful inducement, as well as the chance to be associated publicly with other corporations in a successful project.

How the money or services will be put to work should be clearly and specifically defined. Nebulous statements and unsubstantiated data will create a negative impression. The objectives that the donation will achieve should be reasonable. Grandiose schemes beyond the capacity of the program staff and the institution to implement will have less effect on prospective contributors than realistically attainable results for which some of the support is already in place. It is always a good tactic to remain flexible. While an unrestricted grant of funds directly to the program is probably most desirable from the program director's point of view, a corporation may prefer to give money directly to students, or to establish a work-study program, or to stipulate the use of the funds for another specific purpose.

Large corporations probably require a more polished, more formally prepared appeal than small companies do. Usually there is no single individual at a corporation, but several layers of management or a committee who will review the program before committing to it. The program director must tailor the manner and methods used according to each situation.

In many cases, especially when informal contacts with company officials have exposed them to the program's operations and its aspirations, a full-scale presentation is not necessary. A brief letter to the person designated to receive requests should, however, always be sent. The letter should state the appeal concisely, explain why the support is needed, how it will be used, and—as convincingly as possible—how the

company will benefit. After four to six weeks, a follow-up phone call is in order.

A Formal Presentation

If a meeting to discuss the proposal is scheduled, especially if a number of the company's key people will be attending, a formal presentation may well be expected. Putting together this kind of presentation involves several steps:

1. Determining the tone and style
2. Choosing an overall strategy
3. Developing an attractive package of materials

The tone and style of the presentation should suit the background and experience of the group to which it will be addressed. How interested are they ahead of time in the program? Have they been responsive in the past to similar projects? Have they enjoyed rewarding results from prior commitments? What do they know about minority programs in general and about this program in particular?

The extent of a company's prior experience and knowledge about the program may suggest which of several approaches would be more effective. For example, a presentation can be structured as a narrative—giving the historical background and then bringing up-to-date recent milestones of accomplishment. A company that has not been warmly receptive to such projects may react better to a forcefully persuasive argument with ample data. Another approach can be a straightforward detailing of relevant information organized around clear-cut solutions.

Whatever the style, the presentation should stress the program's strengths. Perhaps it has an outstanding success rate at recruiting minorities—or at retaining them in the engineering curriculum. Are there geographical advantages? Is the faculty commitment to minorities in engineering unusually strong?

The strategy will evolve from the unique features the program can claim together with the reasonable objectives it can promise. The best strategy is a unified, coherent presentation that singles out for emphasis the goal to be attained in terms of the kind and level of support requested. Any data that can justify the premise that X amount will accomplish Y results deserve prominence. Not only will a clear focus on one subject be easier for a group to absorb, it will also appear to be more manageable than a hodgepodge of activities. Thus, one strategy might be to lay out specific plans for improving the retention rate, a known problem and one that, if solved, will benefit a company by increasing the pool of minority graduates who will be coming on the employment market.

The form of the presentation can vary from a talk and a well-executed brochure to accompanying slides or even a film. The visuals should, of course, clearly enhance the verbal presentation. Large corporations are accustomed to sophisticated, glossy materials; it is, however, preferable to keep the information in a simple format rather than to overwhelm an audience at the expense of clarity and coherence or to strain a budget in order to produce elaborate visuals.

At every point in the presentation, the program director should be ready to defend and discuss the proposal at length. Close scrutiny and evaluation are normal procedures in corporate decisions. As in any other situation with company representatives, the more the program director is able to anticipate and respond to their manner of conducting business, the more likely that the relationship will flourish.

HOW TO MAINTAIN GOOD RELATIONSHIPS WITH INDUSTRIAL SUPPORTERS

After a grant of funds or services has been made, the donor should be kept apprised of any noteworthy events and progress toward the expected goals. A thank-you letter is a must, and it can contain an invitation to visit the program at a convenient time. Newsclippings should be routinely forwarded to those at the company who will be interested. Some discretion, however, is advisable. An avalanche of mailings is not as important as selective, informative bulletins and timely telephone chats.

Creating ways to introduce company employees to the program's students can help to cement ties and good feelings. Putting company representatives in direct contact with the students—who are, after all, what the program is all about—should be an ongoing part of the MEP director's activities. Companies should, of course, have the opportunity to interview and recruit graduating students. They should also have occasions to meet students in the earlier years of their college career in order to fully appreciate the scope and the depth of the program. Such meetings aid students in forming more knowledgeable views of the companies, and the students' enthusiasm about the program can be effectively conveyed on a one-to-one level. The following suggests some activities the MEP director can coordinate.

Access to Students

A relatively simple method is to invite a company representative to speak to a group of minority students. A company engineer, ideally one who is a role model, can give a talk about engineering as a career or on a specific technical topic, such as computer-aided design. Students can ask questions afterwards informally. Similarly, a company can send a personnel representative to speak, or someone from management who can provide an overview of the company. On an individual basis, an engineer can take a student to see what a day on the job is like.

Another way to foster meetings between company representatives and students is to encourage the program's graduates to see the industrial supporters when they interview on campus through the placement of-

fice. At the same time, companies should be urged to interview, if they are not already doing so. Should some of the program's graduates accept employment with a company that has made a contribution, a concrete bond will be formed.

To assist in placing the program's graduates with industrial supporters, the MEP director should compile a book of resumes for senior students who will be seeking employment. The resumes can then be sent to supporters early in the year, with a letter suggesting that they actively recruit those who fit their hiring plans. The positive point that will emerge is that the program turns out desirable candidates and that because of their help, supporting companies have the full cooperation of the program in matching them with graduates.

A more ambitious activity can be a career-day on campus in which companies set up displays. A career-day can include a brunch, open question periods, informal conversations with students, as well as scheduled talks by staff and students that further describe the program. It is usually a good idea to organize a career-day in conjunction with the placement office, in case some formal interviewing seems a possibility. Also, the placement office may take on some of the responsibilities for the arrangements.

Honors and Recognition

Gaining access to the program's graduating minority students is probably the primary interest of a donor company. But as a means of making an ongoing relationship with an MEP personally rewarding, company personnel can be drawn in to take more active roles more regularly. The loan of an employee to the program by a company that has a financial commitment can offer an individual, who accepts such an assignment, credit for community service as well as personal satisfaction. The engineer who agrees to teach a course can enjoy the prestige of an adjunct faculty appointment and can experience the stimulation of imparting to students knowledge and practical expertise. Both of these situations not only can relieve tight program and faculty budgets, but, equally important, can produce better understanding between companies and the MEP.

A highly advantageous way to keep in contact with key individuals at sponsoring companies—to recognize their value to the project, and to give them opportunities to deepen their involvement—is to establish an advisory board. There are numerous advantages to doing this. Advisory board members can act as advocates for the program with the administration of the university as well as with other companies, whose officials may be more responsive to a third party than to the program director. Because they sit on the advisory board, they are well-informed about the program and thus prepared to speak for its needs. Also, the more aware they become of the areas in the program that require additional support, the more inclined they should be to expand their commitment. If board meetings are not held too often and if the business of the meeting is not too burdensome, board members can gain a better perspective on how staff, community representatives, and industry can work together for the good of the program.

The advantages to board members from industry are that they have the chance to voice their opinions about the program's projects and can participate in any successes the program achieves. Should they assume the role of advocate for the program, they can feel that they are leaders, encouraging their counterparts in other companies to join in a demonstrably admirable undertaking.

Individuals from industry who invest their time in the program should be further rewarded personally for their efforts. The names of board members can be listed in brochures and newsletters. They can receive a plaque in a special presentation. Photographs of the presentation can be released to the press and also sent to the company for use in its publications. Thoughtful attention to these and other creative ways to express appreciation can make succeeding rounds of fund-raising a more personalized process.

CONCLUSION

The initial phases of seeking industrial support require the MEP director to think carefully about how private companies conduct business and to prepare a business-oriented approach that speaks to the benefits companies gain from giving funds and services to the program. The later phases require that company representatives be kept informed about the results of their support and that their efforts receive appreciative recognition. As individual members of donor companies become more involved in the program—attending a career-day, teaching a class, sitting on a board—the need to fulfill their expectations about what makes a project a justifiable investment remains. At the same time, however, increasing contact between company representatives, students, and MEP staff humanizes the objectives outlined in the original presentation and, on a continuing basis, strengthens the commitment of a donor company to the program's goals.

ACKNOWLEDGMENTS

Joseph Ouellette and Mel Bell, both of IBM, and David O. Tompkins, Associate Director of University Development at Northeastern University, provided valuable ideas for this chapter.

APPENDIX A

MINORITY ENGINEERING PROGRAM EVALUATION FORM

This form is designed to give you an opportunity to evaluate your MEP Center.

Next to each activity indicate whether it is being done well, it needs to be done, or it is not applicable for your program. Make a list of those activities which you need to do and prioritize them for action. Under each major component heading indicate on a scale of 1 to 7 the priority you would attach to the importance of that component and also note your effectiveness in implementing that component. The difference in these two numbers should aid you in deciding where to put your effort. For example, if you give an item a high priority but your effectiveness in implementing it is low, this is an area for attention.

1. *Recruiting* — This includes everything you do to increase the pool of underrepresented ethnic students applying for admission to your university. Appropriate activities in this area include:

	Doing well	Need to do	Not applicable
(a) Development of letters, brochures, and newsletters used to inform students, teachers, and counselors about your program	☐	☐	☐
(b) Mailings about your program to students identified by various sources, including CEEB lists, teacher nominations, etc.	☐	☐	☐
(c) Personal visits to high schools and community colleges	☐	☐	☐
(d) Use of regional pre-college program networks such as MESA, PRIME, SECME, etc., including field trips for their students to your university, direct contact with their staff and teachers, participation in their college days, etc.	☐	☐	☐
(e) Use of campus-wide recruiting sources (campus minority program, relations with schools, etc.) in recruiting students for your program	☐	☐	☐
(f) Bringing high school students to your campus individually, in small groups, or as part of a formal MEP college day	☐	☐	☐
(g) Other (Indicate) _____ _____ _____	☐	☐	☐

Indicate the priority that you feel should go into recruiting in terms of the current needs of your particular program.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate the effectiveness of your recruiting activities on the scale below.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

2. *Admissions* — This includes anything you do to increase the percentage of your applicants who are admitted as engineering or computer science majors at your university. Activities in this area which could be appropriate are:

	Doing well	Need to do	Not applicable
(a) Lobbying for admissions accommodations for ethnic students applying to engineering	☐	☐	☐
(b) Serving on admissions committees or working closely with the person in charge of engineering admissions	☐	☐	☐
(c) Tracking the applications of ethnic students applying for engineering. Doing follow-up to ensure that students complete their applications and that they are processed in a timely manner	☐	☐	☐

(d) Developing alternative admissions evaluation criteria. As an example, interviewing applicants and making recommendations on admissions

☐ Doing well ☐ Need to do ☐ Not applicable

(e) Developing alternate paths for students who either (1) apply after the application deadline or (2) are turned down for admission to engineering. For example, these students could be admitted to the university as undeclared majors with an agreement that upon successful completion of specific courses, they would be accepted into engineering.

☐ Doing well ☐ Need to do ☐ Not applicable

(f) Other (Indicate) _____
_____
_____

☐ Doing well ☐ Need to do ☐ Not applicable

Indicate the priority that you feel you should give the admissions process in terms of the current needs of your program.

1 2 3 4 5 6 7

Low Priority — Average Priority — High Priority

Rate the effectiveness of your efforts to impact the admissions process.

1 2 3 4 5 6 7

Ineffective — Average Effectiveness — Very Effective

3. *Matriculation* — This includes everything you do to assist incoming MEP students between the time they are admitted and the time they sit in their first class. Appropriate activities in this area include:

	Doing well	Need to do	Not applicable
(a) Working to increase the show-rate by mailings and personal contact	☐	☐	☐
(b) Assisting students in finding appropriate housing	☐	☐	☐
(c) Ensuring that students are adequately financed	☐	☐	☐
(d) Ensuring that students have taken necessary math/science/English placement tests	☐	☐	☐
(e) Ensuring that students receive quality academic advising at the entry point and that they are in the appropriate levels of classes, have the best available teachers, and are clustered as much as possible with other MEP students	☐	☐	☐
(f) Ensuring that students get properly registered in these classes	☐	☐	☐
(g) Conducting a summer orientation to aid students in adjusting to the university and to begin some MEP community building. Some or all of the above activities may be implemented as part of this orientation.	☐	☐	☐
(h) Other (Indicate) _____ _____ _____	☐	☐	☐

Indicate the priority you attach to providing students with an effective matriculation process.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate your effectiveness in implementing a program to aid your students with their matriculation.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

4. *Academic Support System* — This includes specific activities designed to enhance the academic experience and success of students, particularly in their first year or two. Activities in this area could include:

(a) Tutoring, particularly structured tutoring such as mandatory tutoring or group tutoring for freshmen

☐ Doing well ☐ Need to do ☐ Not applicable

(b) Effective use of pre-freshman math and science course sequences. As a minimum, this would involve delineating alternative tracks for students in terms of existing courses. In the extreme, it may require modifying or restructuring existing courses to make them more suitable to the needs of MEP students

☐ Doing well ☐ Need to do ☐ Not applicable

(c) Supplementing the early math/science instruction with recitations, shadow courses, workshops, or other formal academic support activities

☐ Doing well ☐ Need to do ☐ Not applicable

(d) Close monitoring of student progress by seeking feedback from faculty, particularly in key math/science courses. This can be done by having students bring in copies of all tests, by getting test scores from faculty, by sending out mid-term evaluation forms, etc.

☐ Doing well ☐ Need to do ☐ Not applicable

(e) Other (Indicate) _____

_____

_____

☐ Doing well ☐ Need to do ☐ Not applicable

Indicate the priority you attach to developing a comprehensive academic support system for your freshmen students.

1 2 3 4 5 6 7

Low Priority — Average Priority — High Priority

Rate the effectiveness of the academic support system you have developed for your students.

1 2 3 4 5 6 7

Ineffective — Average Effectiveness — Very Effective

5. *Freshman Orientation Experience* — This includes structured activities designed to accomplish the following objectives.

(a) Build MEP freshmen (and possibly transfer students) into a community: i.e., a group of people who know each other, who feel part of and have pride in being in the group, and who have a sense of mutual support

☐ Doing well ☐ Need to do ☐ Not applicable

(b) Deliver study skills to include such topics as time management, note-taking, test-taking, problem solving, effective use of instructors, etc.

☐ Doing well ☐ Need to do ☐ Not applicable

(c) Motivate MEP students through an increased awareness of engineering as a profession. This includes role model speakers, presentations by industry representatives and faculty, and field trips to industry

☐ Doing well ☐ Need to do ☐ Not applicable

(d) Orient MEP students to the university and the resources available. This could include academic regulations and procedures as well as use of the library, financial aid system, learning assistance center, etc.

☐ Doing well ☐ Need to do ☐ Not applicable

(e) Other (Indicate) _____
_____
_____

☐ Doing well ☐ Need to do ☐ Not applicable

A key to meeting the above objectives is the establishment of an appropriate structure having sufficient incentives to ensure student participation. An ideal arrangement is the establishment of an MEP freshmen orientation course in which students are registered for academic credit. Where this is not possible, other approaches—regular meetings with incentives such as scholarships, summer jobs, priority registrations, etc.—can be tried.

Indicate the priority you place on the importance of a formal freshman orientation experience.

1 2 3 4 5 6 7

Low Priority — Average Priority — High Priority

Rate your effectiveness in implementing a freshman orientation experience for your students.

1 2 3 4 5 6 7

Ineffective — Average Effectiveness — Very Effective

6. *Student Study Center* — It is desirable for an MEP program to have a student study center of at least 400 square feet per 100 students served. The purpose of this study center is:

	Doing well	Need to do	Not applicable
(a) Provide a home-base operation for MEP students; i.e., a place where MEP students can feel comfortable and always find a "friendly" face	☐	☐	☐
(b) Provide a place for students to study both individually and in groups	☐	☐	☐
(c) Provide space to deliver MEP tutorial services	☐	☐	☐
(d) Serve as a communication center between MEP staff and students and between MEP students	☐	☐	☐
(e) Provide a center of operation for minority engineering student organizations	☐	☐	☐
(f) Other (Indicate) _____ _____ _____	☐	☐	☐

Lockers are an excellent way to tie students to the study center. Furniture should include tables and chairs for study, and abundant blackboard space. Optional furnishing could include couches, refrigerator, microwave oven, drafting tables, computer terminals, etc.

Indicate the priority you would attach to having an adequate student study center which is operating effectively.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate the effectiveness of your student study center in meeting the above objectives.

1	2	3	4	5	6	7
Ineffective or not in place			Average Effectiveness			Very Effective

7. *Academic Advising/Registration/Clustering* — This is the process whereby an MEP student decides what courses he/she will take for the next term and registers for these courses. An ideal process would involve:

(a) Selecting a cadre of student-oriented faculty to serve as advisors to MEP students

☐ Doing well ☐ Need to do ☐ Not applicable

(b) Providing these faculty with training and with resource materials to ensure that they are properly prepared to serve as advisors of MEP students

☐ Doing well ☐ Need to do ☐ Not applicable

(c) Administering an advising process that ensures that each MEP student sits down each term (for at least 20-30 minutes) with an advisor. This may involve notifying students, handling sign-ups, tracking down students who do not participate, etc.

☐ Doing well ☐ Need to do ☐ Not applicable

(d) As part of the above process, identify MEP sections of key math/science/engineering/computer classes based to a great extent on the quality of the teacher and inform the advisors of these MEP sections

☐ Doing well ☐ Need to do ☐ Not applicable

(e) Seeking appropriate accommodations from the university to ensure that MEP students are able to successfully register in the classes they are advised into. This could involve registration priority, restricted sections, block registration, or other approaches

☐ Doing well ☐ Need to do ☐ Not applicable

(f) Other (Indicate) _____

Doing well	Need to do	Not applicable
☐	☐	☐

Indicate the priority you would give to having an effective advising and registration process for MEP students.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate your effectiveness in implementing a high quality advising/registration process.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

8. *Student Organizations* — Although minority engineering student organizations are run by and for students, a goal of the MEP should be to support and foster their development. This can be done by:

(a) Ensuring each student organization has an effective advisor

Doing well	Need to do	Not applicable
☐	☐	☐

(b) Providing resources, both financial and in-kind. In-kind includes the use of telephone, office space, clerical support, xeroxing, etc.

Doing well	Need to do	Not applicable
☐	☐	☐

(c) MEP staff regularly attend meetings and functions and provide suggestions and encouragement

☐ Doing well ☐ Need to do ☐ Not applicable

(d) Other (Indicate) _____

_____

_____

☐ Doing well ☐ Need to do ☐ Not applicable

Student organizations can contribute in the following areas:

(a) Facilitate social interaction of MEP students

(b) Promote academic excellence among MEP students

(c) Provide opportunity for MEP students to develop their leadership skills

(d) Provide service to MEP and the community

(e) Conduct career awareness activities, such as career-days, resume books, field trips, speakers, etc.

Indicate the priority that you attach to your efforts to foster the development of your minority engineering student organizations.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate your effectiveness in working to build strong minority engineering student organizations.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

9. *Tutoring* — As appropriate, MEP centers are expected to develop tutoring services for their students. Implementing an effective tutoring program would involve:

	Doing well	Need to do	Not applicable
(a) Developing and administering an overall tutorial program. For example, tutoring could be on a laboratory basis in the student center, on an appointment basis with sign-ups handled by the MEP office, or in group tutorials, etc.	☐	☐	☐
(b) Advertising, accumulating applications, interviewing, and selecting tutors	☐	☐	☐
(c) Training tutors to increase their effectiveness	☐	☐	☐
(d) Monitoring the performance of tutors	☐	☐	☐
(e) Ensuring that the tutorial program is responsive to MEP student needs, for example, in terms of accessibility, hours scheduled, subject areas covered, etc.	☐	☐	☐
(f) Other (Indicate) _____ _____ _____	☐	☐	☐

Rate the priority you would place on tutoring for your program.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate the effectiveness of your tutoring program as it contributes to the academic success of your students.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

10. *Personal Counseling* — Each MEP program should make an effort to meet the personal counseling needs of MEP students. Counseling needs can be met as follows:

	Doing well	Need to do	Not applicable
(a) MEP director and other staff meet with MEP students at the initiation of the student	☐	☐	☐
(b) MEP director and staff structure regular scheduled appointments with MEP students	☐	☐	☐
(c) Use of counseling center staff either by referral of students or by arranging, for a specific amount of the counselors, time to be devoted to MEP students	☐	☐	☐
(d) Use of other counseling resources, including peer counselors, faculty, and industry representatives, such as role model engineers, etc.	☐	☐	☐
(e) Other (Indicate) _____ _____ _____	☐	☐	☐

Indicate the priority which should go into providing personal counseling to your students.

1	2	3	4	5	6	7
Low Priority			Average Priority			High Priority

Rate the effectiveness of counseling services available to MEP students.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

11. *Summer Jobs* — MEP programs work to see that as many students as possible have the opportunity to have an engineering/computer science-related summer job. Activities in this area could include:

	Doing well	Need to do	Not applicable
(a) Developing a resume for each MEP student seeking summer employment and distributing these to industry	☐	☐	☐
(b) Informing MEP students about various career and summer job fairs and encouraging them to attend	☐	☐	☐
(c) Contacting companies directly to identify opportunities and refer students to positions or arrange on-campus interviews administered by MEP	☐	☐	☐

(d) Utilizing campus placement office staff and resources to assist MEP students in summer placement

☐ Doing well ☐ Need to do ☐ Not applicable

(e) Arranging resume writing and interview workshops and seminars to ensure that students are effective in presenting themselves to be considered for summer employment

☐ Doing well ☐ Need to do ☐ Not applicable

(f) Other (Indicate) _____
_____
_____

☐ Doing well ☐ Need to do ☐ Not applicable

Indicate the priority you attach to efforts to place MEP students in summer jobs.

1 2 3 4 5 6 7

Low Priority — Average Priority — High Priority

Evaluate your effectiveness in assisting MEP students with summer jobs placement.

1 2 3 4 5 6 7

Ineffective — Average Effectiveness — Very Effective

12. *Scholarships* — MEP centers work to enhance students' financial situation by identifying various scholarship opportunities. Activities in this area could include:

	Doing well	Need to do	Not applicable
(a) Administering NACME scholarships	☐	☐	☐
(b) Nominating MEP students for various scholarships given by industrial or professional organizations	☐	☐	☐
(c) Nominating MEP students for various scholarships administered by the university or by the engineering school	☐	☐	☐
(d) Generating resources to create MEP scholarships. These could be administered based on need, academic excellence, academic improvement, or other criteria	☐	☐	☐
(e) Aiding students in understanding various state and federal financial aid sources for which they can apply	☐	☐	☐
(f) Other (Indicate) _____ _____ _____	☐	☐	☐

Indicate the priority you would place on your efforts to identify scholarships for your students.

1 2 3 4 5 6 7

Low Priority — Average Priority — High Priority

Rate the effectivenss of your efforts to obtain scholarships for your students.

1	2	3	4	5	6	7
Ineffective			Average Effectiveness			Very Effective

Summarize the priority and effectiveness you indicated under each program component. Compute the difference ("effectiveness" minus "priority"). Indicate a ranking from highest to lowest on a scale of 1 to 12. This ranking should help you in determining where you need to increase your efforts in order to increase the effectiveness of your program.

	Effectiveness	Priority	Difference	Ranking
Recruiting	☐	☐	☐	☐
Admissions	☐	☐	☐	☐
Matriculation	☐	☐	☐	☐
Academic Support	☐	☐	☐	☐
Freshman Orientation Experience	☐	☐	☐	☐
Student Study Center	☐	☐	☐	☐
Academic Advisement/Registration	☐	☐	☐	☐
Student Organizations	☐	☐	☐	☐
Tutoring	☐	☐	☐	☐
Personal Counseling	☐	☐	☐	☐
Summer Jobs	☐	☐	☐	☐
Scholarships	☐	☐	☐	☐

After you have completed this form, meet with your Faculty Sponsor or Dean of Engineering and discuss it in detail.

MEP Director	Faculty Sponsor / Dean

APPENDIX B

List of Authors

Enrique Ainsworth
Director
Minority Engineering Program
California State University, Northridge
Northridge, CA 91330
(818) 885-2191

David Blackman
Assistant Dean of Engineering
Northeastern University
360 Huntington Avenue
Boston, MA 02115
(617) 437-2156

Margaret Boulding
Director
Minority Engineering Programs
Case Western Reserve University
Cleveland, OH 44106
(216) 368-2904

Robert Finnell
President
NACME, Inc.
3 West 35th Street
New York, NY 10001
(212) 279-2626

Dr. Ronald Glenn
Associate Director
University Community Educational Program
University of Pittsburgh
Pittsburgh, PA 15260
(412) 624-6588

Kathy Hada
Administrative Assistant
Minority Engineering Program
California State University, Northridge
Northridge, CA 91330
(818) 885-2191

Dr. William Hogan II
Vice President for Marine and Defense Systems
Honeywell, Inc.
600 Second Street, NE
Hopkins, MN 55343
(612) 931-5980

Kathryne J. Kelsick
Counselor
Engineering/Science Placement and Career Planning Office
School of Engineering and Applied Science
UCLA
Los Angeles, CA 90024
(213) 825-4606

Dr. Raymond B. Landis
School of Engineering and Computer Science
California State University, Northridge
Northridge, CA 91330
(818) 885-2191

Cassandra Maxwell-Simmons
Assistant Director
Career Center
Cornell University
14 East Avenue
Ithaca, NY 14853
(607) 256-5221

Dr. Deborah A. Minor
Executive Director
Chicago Area Pre-College Engineering Program
300 West Adams Street
Chicago, IL 60606
(312) 726-4137

Joel Nossoff
Director
Minority Engineering Program
California State University, Los Angeles
5151 State University Drive
Los Angeles, CA 90032
(213) 224-3550

Richard Ortega
Director
Minority Engineering Program
California State University, Sacramento
6000 Jay Street
Sacramento, CA 95819
(916) 454-6699

Dr. G.F. (Jerry) Paskusz
Director
Program for Minority Engineering Students
University of Houston, Building D
4800 Calhoun
Houston, TX 77004
(713) 749-1139

Dr. Benson E. Penick
President
Benson Penick & Associates
408 M Street NW
Washington, DC 20001
(202) 638-0433

Dr. Chenits Pettigrew, Jr.
Director of Special Programs
School of Engineering and Applied Science
UCLA
Los Angeles, CA 90024
(213) 825-4606

Christine Reyes
Minority Engineering Program
California State University, Northridge
Northridge, CA 91330
(818) 885-2191

Dr. Ron Simmons
Assistant Dean
College of Engineering
Cornell University
Ithaca, NY 14853
(607) 256-7414

Dr. Esteban Soriano
Division of Engineering and Technical Services
Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720
(415) 486-7194

Nathaniel Thomas
Director
Pre-University and Minority Programs
Illinois Institute of Technology
10 West 32nd Street
Chicago, IL 60616
(312) 567-5111

P. Uri Treisman
Associate Director
Professional Development Program
University of California
Berkeley, CA 94720
(415) 642-5881